The Dock and Harbour Authority

No. 218. Vol. XIX. Edited by BRYSSON CUNNINGHAM, D.Sc., B.E., F.R.S.E., M.Inst.C.E. DECEMBER, 1938

Editorial Comments

A Californian Port.

It will prove, we hope, an agreeable change in the character of our leading article and illustrated Supplement, if, after a series of surveys of ports in the Old World, we transfer our attention for the time being, to the New, and, crossing the Atlantic and the North American Continent, find a novel subject in the modern port and harbour of San Diego, California, U.S.A. The epithet "modern" is justifiable, because although the locality was settled as far back as the close of the 18th century, it was not until about a quarter of a century ago that active port development works were put in hand. Since then, the municipality have been industrious in promoting extensions from time to time as the growing commerce of the place has demanded.

Our readers will be able to read in Mr. Brennan's article in this issue, about the steps taken to improve the berthage accommodation of what in itself is a very fine and well-sheltered harbour, remarkably free from strong winds, and to increase the facilities for handling cargoes, which, of late years, have been arriving in continually increasing quantities. It will be noticed that there is a very heavy preponderance of imports over exports, the ratio being something like 30 to 1. This, of course, is not altogether a satisfactory feature from the shipping point of view, since a vessel arriving with cargo may find difficulty in securing a return freight, and may have to make its homeward voyage in ballast. The fishery industry seems to flourish, particularly that section of it engaged in catching and canning tuna.

It is of interest to note that further developments of the port are scheduled for the immediate future, and there is, indeed, every reason for believing that the American port on the western shore of the Pacific Ocean will continue to expand and prosper under the direction of its enterprising administrators.

As in the case of a number of other United States ports, the Harbour Commissioners are appointed by the Mayor of the City and act virtually as representatives of the City Council, so that the method of governance of the port is, to all intents and purposes, municipal in character. But the maintenance and improvement of the navigable entrance channel and deepening operations by dredging are, as is the general practice in the United States, carried out under Federal authority by the Corps of Engineers of the United States Army.

Unification of River Administration.

In a recent comment we alluded to the action taken, or rather to the expression of views enunciated, by the Tyne Improvement Commission, in regard to a proposal for amalgamating under the sole jurisdiction of the Commissioners the various riparian interests along the banks of the lower Tyne, which at the present time are administered partly by the Commissioners and partly also by various corporations and urban authorities. We commended the proposal as a very desirable step and one likely to be beneficial in promoting the welfare of the whole district as far as navigation and quayside accommodation and facilities are concerned, instancing in support of the proposal the example set on the Thames by the creation of the Port of London Authority, though, even in this case, it has to be admitted that full and complete exercise of control over the riverside wharves has not yet been attained.

The movement on the Tyne has been followed by a similar movement on the Clyde. At a recent meeting of the Clyde Navigation Trust, the Chairman, Mr. W. F. Robertson, moved a resolution in the following terms:—

> "That the Trustees consider the effect upon the harbour, river and other development on the Clyde of the present division among several statutory authorities of functions affecting the river, and whether it would be advantageous in the general interest to see the amalgamation of any of those authorities, and that as a first step the Trustees remit the question to the committee on Law and Parliamentary Bills for investigation and report, with power to consult the authorities concerned with a view to reaching agreement on any proposed action."

Mr. Robertson went on to explain that no concrete action was suggested for the moment, and that all that was desired was a survey of the position in order to determine the course which might be best to pursue. After support from Councillor P. J. Dollan, who seconded, and several other members, the resolution was unanimously approved.

Quite a number of considerations can be adduced in favour of the unification of authority over a navigable river which serves a variety of riparian interests, especially in securing a uniform and comprehensive policy for the improvement of the channel and approaches, and in determining the main lines of riverside development. It is not unnatural that some local opposition to the proposal should manifest itself, partly on account of supposed loss of prestige and freedom of action, but such objections could be overcome by adequate provision for representation of all the individual bodies concerned in the welfare of the river, and, in any case, the public advantage must undoubtedly be the overriding consideration.

The Mittel-land Canal.

The opening to traffic of the great arterial waterway through central Germany, known as the Mittel-land Canal, which took place on October 30th, is a notable event in inland navigation, and the fact that Berlin, in the heart of the continent, is now a port accessible to vessels of as much as a thousand tons burthen is sufficiently striking to induce a moment's reflection on the sorry condition of canal systems as a whole in this country. The traffic on the German inland waterways far exceeds anything in the British Isles; as much, in fact, as the capacity of the canals themselves is in excess of British standards.

Last year a total of about 130 million tons of cargo was carried on German inland waterways, and the returns show a continuous increase. Indeed, the trouble presenting itself at the present time is an insufficiency of craft: there is a call for an additional 1½ million tons of shipping to meet the increasing demands of traffic and the necessary replacement of obsolete craft.

A description of the canal will be found elsewhere in this issue. It will be seen that it runs through some of the most important industrial centres in Germany, linking up Berlin with the manufacturing regions of Westphalia and the Rhineland. The facilities thus afforded to the industries of Western Germany for cheap water-borne transport to the other side of the Reich are of the highest importance, and when, in the near future, there is an extension of the Mittel-land system, by way of the Rhine-Main-Danube Canal, through Eastern Europe, to the Black Sea, the scope for the development of German trade to the East will be enormously increased.

Editorial Comments—continued

The Ports and the International Crisis.

Before the keen interest manifested in deficiencies in the national defence preparations during the recent international crisis is allowed to subside, readers, especially those in government circles, will do well to take into consideration the subject of the letter in our correspondence column this month from Mr. D. Ross-Johnson, formerly General Manager of the Port of Bristol Authority and for some time a Vice-President of the Institute of Transport. Mr. Ross-Johnson very earnestly and cogently emphasises the need for prompt and energetic measures to place the ports of the country in a position to deal effectively with the local congestion of shipping and traffic which will inevitably arise in time of war. We have ourselves so frequently directed attention to the value of British internal waterways in this connection that it is unnecessary on this occasion to do more than warmly endorse the representations which Mr. Ross-Johnson makes in his communication.

While on this subject, we may touch on a cognate matter. Rather belatedly, it seems to have struck the officials concerned that if, in consequence of a national emergency in war time, shipping were to be diverted from the East Coast of Great Britain to ports on the Western side, more particularly in South Wales, there would be shortage of dry dock accommodation for the purpose of effecting ship repairs to vessels of large calibre. There are a number of large-sized graving docks in the Mersey, but in the Bristol Channel there is alleged to be a serious shortage. It is stated in a communication to the press that out of a total of 19 docks, only 7 are capable of accommodating modern cargo liners. Five of them are entered from tidal waters and only two can be considered available at any stage of the tide.

Without attempting to verify these figures, it is sufficient to comment that graving docks cannot be conjured into existence at a moment's notice, and that if of any size, they usually require a few years to build. If, therefore, the shortage is already apparent, it cannot be rectified immediately, and, without depreciating the advantages claimed for graving docks, it may be desirable policy to have some additional floating docks available as soon as possible. These could certainly be constructed within a relatively short period, and they would serve to tide over the difficulty which presents itself in getting dry dock accommodation in a reasonable time. Moreover, they have the advantage of mobility and could be towed from one port to another. The matter is one of serious concern and the authorities would be well advised to give it earnest attention.

Maritime Passenger Stations.

The Southern Railway are to be complimented on their timely enterprise in deciding upon a much-needed improvement of the passenger accommodation at Folkestone Harbour Station. The existing station, and its connection with the landing quay, have never been acceptable to the multitude of cross-channel passengers, who have had to avail themselves of such exiguous and cheerless shelter as is afforded thereby, after the rigour of a stormy crossing. Even in fine weather and under favourable conditions, the station has not constituted a very attractive feature to the traveller. The proposal of the Railway Company, as set out elsewhere in this issue, to spend a substantial sum in re-modelling the station and in providing more effective shelter for passengers will, therefore, be warmly welcomed.

We have called attention more than once, and in particular in a lecture delivered two years ago to the Institute of Transport, to the inferior standard of many of the maritime landing stations in this country as compared with the very modern, thoroughly artistic and even palatial installations to be found on the Continent of Europe. In this respect, Great Britain is distinctly behind the spirit of the times, which demands that travellers should, at least, receive the same degree of comfort at the port of arrival or departure, as they have received while travelling at sea, or is accorded them in the metropolitan termini.

Cross-Channel Embarkation Arrangements.

The foregoing comment was written before the appearance of the Paper on " Cross-Channel Services from the Passenger Viewpoint " read before the Institute of Transport on November 14th, by Mr. A. C. Hardy, who, at an earlier date produced, with Mr. Pierre de Malglaive, a joint Paper on " The Transatlantic Liner of the Future." Mr. Hardy's incidental observations on the embarkation arrangements in connection with cross-channel passenger traffic are so á propos that we quote the following passage.

After specifying certain directions in which improvements on board vessels are desirable, he adds:—

" With these improvements—urgently needed in some cases—will naturally have to come an overhauling of the embarkation conditions ashore. The guilt in this respect is shared equally by foreign railways and our own, and the only real maritime cross-channel station with covered embarkation in existence, is the L.M.S. station at Holyhead, the finest of its kind in the world. Of what use, for instance, to expect the passenger to spend anything from one and a half to eight hours in a warm even overheated train, and then ask him to leave, walk across a draughty platform through a dirty Customs inspection shed, and then across a hundred yards of open exposed, often rain-swept quay! That is not all, for in many cases, when the passenger boards the vessel he is compelled to walk, with his baggage, the length of an open, wet, slippery deck, before finally entering a narrow jostling companion-way to proceed down into the ship in search of his cabin along narrow and tortuous alleyways. Bad shore arrangements are not altogether due to lack of thought, for the majority of cross-channel quays have never been re-built, but merely added to since their inception upwards of 50 years ago. Uncomfortable conditions afloat are attributable in some measure to a tendency that each time a railway company lays down a fleet of new cross-channel ships, the plans of the previous vessel are taken down, the dust blown off them, and a few apologetic modifications made, warranting the attachment of the adjective " new " to the product of the builder's yard."

We commend to the various authorities concerned a consideration of the necessity for a totally different conception of a maritime passenger station from that which has prevailed hitherto.

An Unsatisfactory Position at Memel.

Somewhat severe strictures are expressed in a recent Special Circular of the Baltic and International Maritime Conference on the unsatisfactory conditions at the Lithuanian Port of Klaipeda (Memel) during the prevalence of west and north-westerly winds. It is alleged that since the North Pier in the Outer Harbour (from the Custom House to the Petroleum Tanks) has been extended and connected with the North Mole, a heavy swell is generated in the harbour during westerly winds, affecting the entire area. The result is stated to be that " it is now almost impossible for any craft, whether small or large, to be moored alongside the quays in the harbour (River Dange occasionally excepted) without running the risk of sustaining damage through bumping against the quayside whenever a strong breeze or moderate gale is blowing." During a recent experience, all ships had to cease work for two or three days and move out to anchor in the stream. A number of ropes and wires were snapped and several large steamers broke adrift.

The remedy suggested for this unsatisfactory state of affairs is the extension of the Outer Pier or the building of a breakwater outside the harbour. Memel has not a very good reputation for shelter, and the entrance to the harbour during westerly winds has been described as " precarious." Apparently, the enlargement of the Outer Harbour by the constructional alteration referred to above, has left the enclosed area in a more exposed position, for which shelter will have to be provided, if ships are to moor in safety. This defect is unfortunate, and it will have a detrimental effect on the popularity of the port and its trade, unless early steps are taken to remedy the grievance of shipmasters and owners in regard to detention and delay. No doubt, the Lithuanian Government will move in the matter to remove the reproach from the only port and sea outlet of the country. Almost the entire trade of Lithuania passes through Memel.

The Liverpool Dock System.

Sir Sydney Jones, partner in the Blue Funnel Line, on the recent occasion of his election to the dignity of Lord Mayor of Liverpool, took the opportunity to pass an encomium on the dock system of the Port, which, he said, " earned the admiration of the world." He commented on the past history of the port, stating that it was a long one, and in its beginning not a very distinguished one. In fact, there was a time," he said, " in the Elizabethan Age, when Liverpool described itself as a ' poor, decayed place,' and asked Queen Elizabeth to let it off some harbour dues. Its greatness began about the middle of the 18th century, and from then onwards, Liverpool was ready to take advantage of all opportunities given to it in the industrial arena and during the age of steam. During the 19th century he supposed there was no harbour in the world where the name of Liverpool was not known, and over the whole of the Seven Seas her merchant lines challenged those of any other port."

This tribute to the enterprise of the northern port is well merited, and the position which Liverpool occupies at the present day in the overseas commerce of the country, and particularly in the export trade, is conclusive evidence of the success which has attended a wise policy on the part of the port administration.

It is appropriate to allude here to a notice of the second of Liverpool's Dock Engineers (Henry Berry, 1720-1812), which appeared in a Paper read before the Historic Society of Lancashire and Cheshire by Mr. Harris on December 9th, 1937, and which has been reproduced in the last two issues of our contemporary " Mersey." Although not so notable a character as his predecessor, Thomas Steers, he played an important part in the development of the port accommodation, and particularly in connection with the construction of the George's Dock, completed in 1771, and the King's Dock completed in 1788. He died in 1812, at the advanced age of 92.

An Aerial View of Municipal Pier No. 1, and Broadway Pier and (on right) U.S. Navy Pier

The Port of San Diego, U.S.A.

An Enterprising Californian Port

By J. W. BRENNAN, Port Director

Early History

FIFTY years after Christopher Columbus discovered America, the navigator, Juan Rodriguez Cabrillo, was sent northward from the west coast of New Spain (now known as Mexico) on an exploring expedition, and found "a land-locked and very good harbour," later named San Diego Bay. Cabrillo's discovery in 1542, was followed in 1602 by a surveying expedition led by Sebastian Viscaino, who reported "here was a fine place for Spanish settlement." Action on this advice, however, did not follow until 1769, when land and water expeditions were organised under the command of Don Gaspar Portola, the Governor of Lower California, which was already an organised territory. The expeditions were accompanied by Franciscan missionaries, whose duties were to establish missions, convert the natives and, politically, to evidence possession of the country by Spain. Thus was established the first of California's chain of 21 missions—San Diego de Alcala.

The revolt of the Mexicans against Spain, in the early part of the nineteenth century, finally brought Mexican rule to San Diego in 1834, and with it confiscation of mission property and the establishment of a Mexican pueblo. American succession followed in 1846, and the incorporation of the City of San Diego was effected four years later.

Capt. J. W. Brennan, Port Director, San Diego Harbour Commissioners

Location and Description of the Harbour

San Diego is situated about ten miles north of the boundary between the United States and Mexico. It is 452 nautical miles south-east of San Francisco. The entrance to the bay, on the east side of Point Loma, lies in Latitude 32° 42′ North, and in Longitude 117° 10′ West. The city is on the north and east shore of the bay, about five miles from the harbour entrance.

The harbour is land-locked, free from currents, safe at all seasons, and easily accessible for all types of vessels in any kind of weather conditions. It is the first United States port of call north of the Panama Canal and one of the three natural deep-water harbours on the Pacific Coast.

The area of the harbour is 22 square miles, and the depth of water over the bar, at low tide, is 40-ft. The main channel leading from the bar to the wharves averages 1,500 to 2,000-ft. in width, and from 35 to 70-ft. in depth at low water. The anchorage area is approximately 1,400 acres, being six miles long and 2,000-ft. wide, with depths ranging from 25 to 50-ft.

Weather Conditions and Tides

The harbour is navigable throughout the entire year, and entirely free from objectional currents and ground swells. The average wind velocity is 6.7 miles per hour. The strongest wind ever recorded over a 66-year period is 43 miles per hour, and has occurred but once throughout this period. Winds reach a velocity of from 25 to 35 miles per hour about three times a year, and are of but short duration. The annual distribution of the wind would give the following percentages from eight points of the compass. North and north-east 8; east 4; south-east 3; south 7; south-west 13; west 22; north-west 35 per cent. May is the month with the greatest amount of wind; and December records the least.

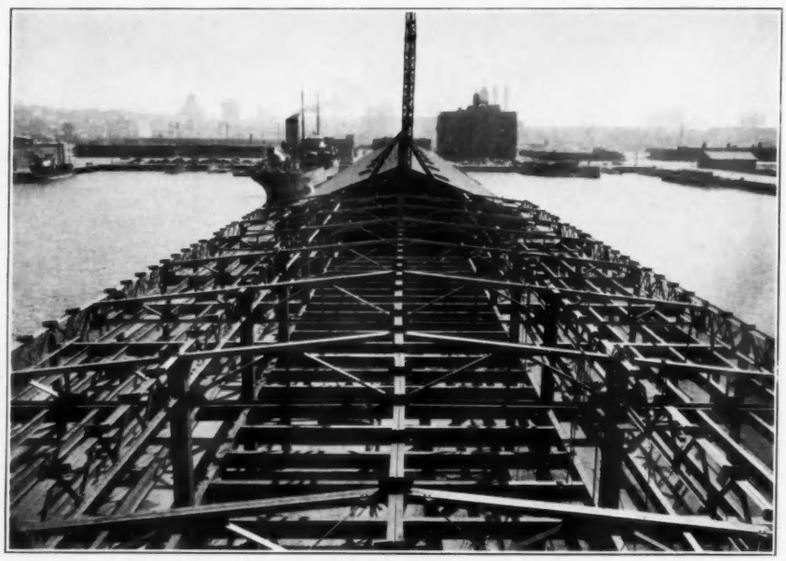
Fogs are seldom of such a nature as to interfere with navigation. They are most prevalent during the winter months and usually occur at night, disappearing in the early morning.

The mean range of tides at the harbour entrance and within the bay is 3.9-ft. Tidal currents generally follow the channel and vary from 1 to 2.5 knots, according to the state of the tide.

Port Administration and Control

The administrative control within the city of San Diego is vested in the Harbour Commission, consisting of three members, who are appointed by the Mayor of the City, and serve without remuneration for terms of four years each. The Commission exercises in the name of the City, such powers as are prescribed by general laws, together with such additional powers and duties as may be prescribed by the City Council or the laws of the United States. These duties include the jurisdiction, supervision, management and control of the Bay of San Diego fronting upon the City (about a third of the total bay frontage of 31 miles), and also the authority to lease tidelands for business connected with commerce, navigation and fisheries.

Port of San Diego, U.S.A.—continued



Pier Shed under Construction

The chief administrative officer is the Port Director, who is appointed by the Harbour Commission, together with such other officers, employees and subordinates as may be necessary to insure the satisfactory working of the port.

Stages of Port Development

The San Diego Municipal Tidelands comprise a strip of ground between the Mean High Tide Line and the U.S. Bulkhead Line, extending seven miles from the north line of the U.S. Military Reservation on Point Loma to the westerly boundary line of National City. The bulkhead line defines the limit of solid land, while the pier-head line defines the limit to which open piled structures may be built, and is located in varying distances up to 1,000-ft. beyond and parallel to the bulkhead line.

The present Tidelands cover an area of 1,712 acres, 973 acres of which is under the City's control, the remaining 739 acres having been deeded at various times to the U.S. Government for Army or Navy purposes; 396 acres have been allotted for airport activities, and 252 acres are available for industries requiring water frontage or water transportation.

Some conception of San Diego's progress is apparent when it is realised that before 1912 all the tidelands were under water at high tide. A three-fold purpose has been accomplished by dredging the bay:—(1) The bay has been deepened to accommodate larger vessels; (2) valuable ground has been reclaimed with the spoil; (3) the unsightly mud flats at low tide have been eliminated. Harbour improvements to date have cost the City approximately $5,500,000, while the Federal Government have spent over $4,200,000 on dredging.

Active port development began in 1912, and by the end of 1915 Broadway Pier was completed, together with the dredging of a channel 32-ft. in depth, to permit vessels to leave the main channel and berth alongside the pier. The original structure, 130-ft. by 800-ft., consisted of a reinforced concrete deck supported by wood piles encased in concrete, with a structural steel frame cargo shed 72-ft. by 725-ft., and a two-storey head-house. In 1932, the pier was lengthened 200 lineal ft., the old shed removed and a modern two-storey freight and passenger depot constructed. Cargo is handled on the lower floor, which measures 97-ft. by 939-ft. The upper storey, 65-ft. by 926-ft., is subdivided, providing office space and accommodation for passengers. A large public auditorium was constructed at the outboard end of the pier. The estimated cost of the Broadway Pier and its added improvements is $750,000.

Following the construction of the original Broadway Pier, progress continued, and in 1926, Mole Pier No. 1 was built at a cost of $1,000,000. As its name implies, this is a mole pier, 400-ft. by 1,000-ft., surrounded by a reinforced concrete apron wharf 60-ft. in width, supported by reinforced concrete piling. Seven standard gauge railway tracks lead out on the dock, the three centre tracks are depressed to provide loading platforms for loading directly into trucks. A large cargo shed of structural steel frame, 145-ft. by 933-ft., with a two-storey head-house, occupies the south portion of the pier, and a smaller shed, 73-ft. by 725-ft., was constructed on the north portion.

November, 1935, marked the beginning of a further extensive programme of construction, and by January, 1936, six schemes involving the expenditure of over $2,500,000 were in hand, among them being the following:—

The dredging of 4,500,000 cu. yds. of material, and the reclamation of 200 acres of municipal tidelands; the completion of the Navy Sports field, located on the south front between the foot of Fifth Avenue and Battery Park; and the paving of the seaplane landing area and taxi strip at the Municipal Airport.

The greater part of these improvements have now been completed, and in addition, the City has constructed approximately 6,000 lin. ft. of permanent reinforced concrete bulkhead and 3,000-ft. of reinforced concrete apron wharf 25-ft. in width. At present rip-rap bulkheads are being constructed: these are hand-laid. Some stretches are cement grouted, and other portions are laid up loose. About two miles have been completed, and to all indications serve as a satisfactory protection for the shore lines of the new dredger disposal areas.

Main Channel Dredging

A dredging project for widening the main channel to 2,200-ft. along the westerly limits of North Island, and the reclamation of 580 acres of Government property, was completed last October at a cost of $1,200,000. Additional Federal dredging schemes, involving the removal of 30,700,000 cu. yds. of material and the reclamation of 1,192 acres of land have been approved, and it is anticipated that work will be started on part of this programme before the end of this year, as Congress has recently appropriated $500,000 for dredging operations in Area M, which is a part of the project. The cost of the total project as approved is estimated at $4,180,000.00.

Further Improvements Contemplated.

Improvements proposed during the next few years include the construction of a mole-type pier, 600-ft. by 1,150-ft., at the foot of 10th Avenue, to relieve the congestion existing at the present time on Mole Pier No. 1. Included in the scheme is the dredging necessary for the fill and the reclamation and development of approximately 20 acres of municipal tidelands adjacent to the proposed pier. The total cost of the pier, dredging and tideland development is estimated to amount to $1,800,000.

Port Facilities

The harbour embraces many wharves, two of them being the large municipally-owned piers already described, with 9,310-ft. of public berthing space. Private wharves have a berthing capacity of 7,274-ft., making a total berthing space, excluding Government-owned wharves, of 16,584-ft.

There are three large warehouses with 224,400 sq. ft. of floor space, one private grain elevator of 150,000 bushel capacity, and four marine repair shops. The warehouse facilities provide accommodation for all classes of merchandise, together with modern equipment for the handling of goods, including gas and

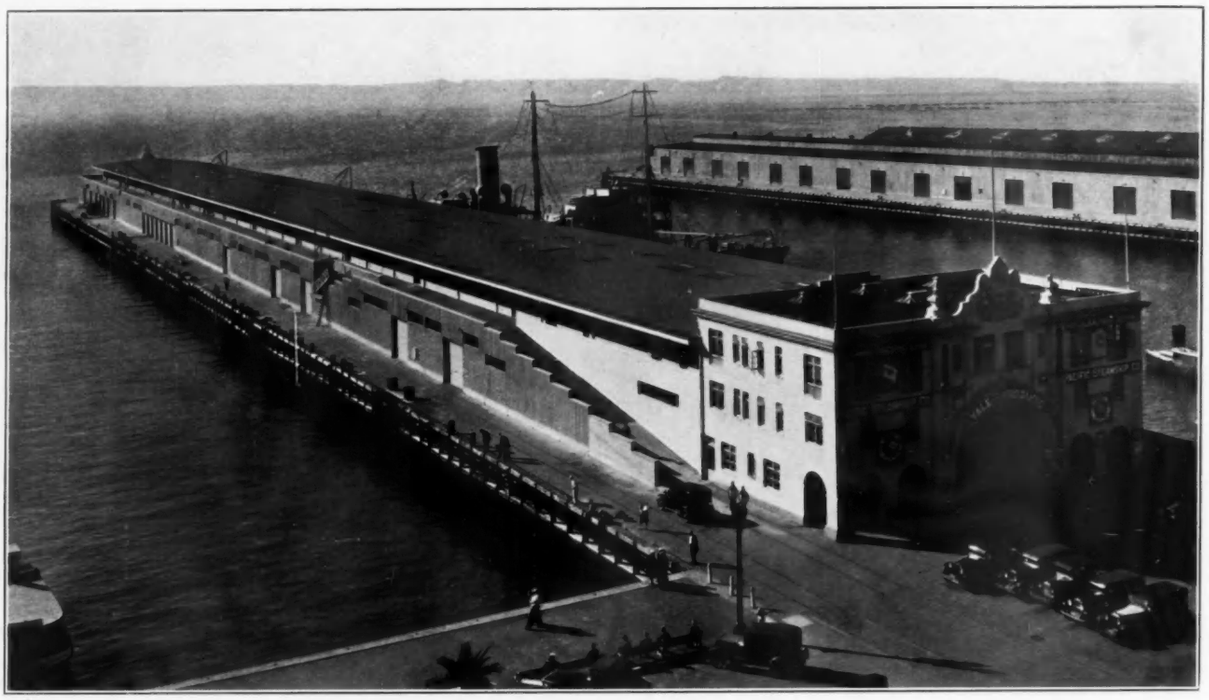
View of Second Storey of Reconstructed Municipal Broadway Pier

Port of San Diego, U.S.A.

An Aerial View of San Diego Harbour

Busy Shipping Scene at Municipal Docks

Port of San Diego, U.S.A.—continued

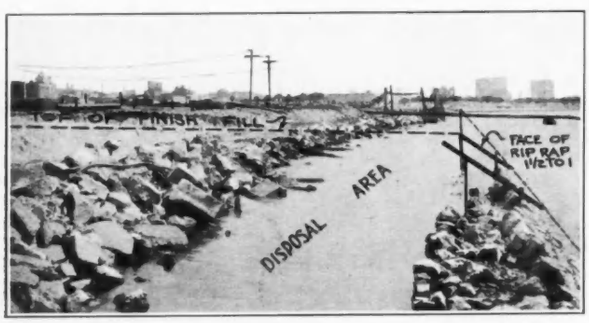


Front View of the reconstructed Municipal Broadway Pier. Passengers land on the Second Floor and pass along Ramps leading direct to the Street

electric tractors, electric portable cranes, escalators, piling machinery and assorted trucks designed for various uses.

Fishing Industry

San Diego is one of the principal centres of the Tuna Canning Industry of Southern California. The activities of the tuna fleet



Rip-rap Bulkhead

cover an area of approximately two-thirds the size of the United States. Boats operate south of the Equator, and some of the fishing banks are as far as 1,000 miles offshore. During the fiscal year, 1936-37—1,408,238 cases of tuna fish were packed at the port, an increase of 177,050 cases over the previous year.

In addition to the above, 15,310,000 pounds of fish meal and 260,059 gallons of fish oil were produced, as well as 117,414,639 pounds of fish, over 106 million pounds of the latter being canned at the five local canneries. Fish dried and salted amounted to 104,501 pounds.

Trade of the Port

The trade of the Port of San Diego has progressed considerably during the past decade, the tonnage and value of cargo having increased by several hundred per cent.

The tonnage handled for the year 1936-37 amounted to:—

Inwards—583,855 tons.
Outwards—18,447 tons.
Total Inwards and Outwards—602,302 tons.
During the same period vessels arriving and departing numbered 978.
The number of passengers inwards and outwards totalled 1,345.

The chief imports were cement, creosote, fish, lumber, petrol, oil, paper, steel and general merchandise, and the chief exports were fish (fresh and canned), cotton, soap powder, fruits and vegetables, olives, gypsum, hides, scrap iron.

Municipal Airport

The combined seaplane and aeroplane base, which is located on the shore of San Diego Bay, within five minutes' ride of the city, is under the control and supervision of the Harbour Commission.

The transport hangars, administration building, aircraft manufacturing plants, Government aeronautical school, repair and service stations are situated along the eastern boundary. The Administration Building embraces a modern waiting room, ticket office, public cafe, and the United States Customs and Immigration Offices.

Along the southern boundary of the field, covering an area of 11½ acres, are the newly-constructed U.S. Coast Guard Station, and the mammoth hangar, seaplane ramp, garage, mess-rooms and quarters for the men.

Adjoining the Coast Guard site on the east, is the Municipal Seaplane Landing, covering an area of five acres. A large portion of the landing is concreted, and joins the concrete seaplane ramp, 100-ft. wide and 240-ft. long, extending easterly into the seaplane basin.

The field now has 175 acres of reclaimed land in active operation; an additional 25 acres has been reclaimed and is ready for surfacing, leaving a remaining area of 153 acres to be reclaimed.

Port Staff Changes and Appointments.

Mr. O. H. Lewis, who has been associated for 27 years with the Port of Bristol Authority, has been appointed clerk to the Southampton Harbour Board in succession to Mr. W. G. Gubbins. The appointment will date from December 1st, but Mr. Lewis will not take full control until April 1st, 1939, when Mr. Gubbins retires.

Mr. J. D. Ritchie, M.C., General Manager of the Port of London Authority, has been appointed to represent the P.L.A. on the National Council of Port Labour Employers and the Port Employers in London.

Mr. F. W. Way, who recently retired from the position of docks manager of the Manchester Ship Canal Co., completed nearly 50 years' service with the company. Mr. W. J. Bruce, assistant docks manager, has been appointed his successor, and assumed the duties of Docks Manager on 1st November last.

Captain A. M. Chr. Wegeberg has been appointed harbourmaster of Esbjerg in place of Mr. V.P.A. Larsen, who recently resigned his position for reasons of ill-health.

Mr. F. D. Alward has retired from the position of harbourmaster of the Port of Saint John, New Brunswick, after forty-eight years' service. He is succeeded by Mr. W. A. Charlton, who for the last twenty-three years has filled the position of assistant harbour-master.

Mr. James Yeaman, traffic superintendent at Dundee Harbour, has died suddenly at his home in Dundee. He had been thirty-six years in the service of the Harbour Trustees.

The Administration of the Small Port

By BASIL MARSDEN-SMEDLEY, B.A. (Member of the London County Council, and formerly member of Transport Advisory Council)

[Paper read at the Summer Conference of the Institute of Public Administration, Bristol, July, 1938]*

Public administration is not an end in itself, but a means to an end. That end is clearly to provide for mankind the public services demanded by him for the maintenance and improvement of his standard of living and civilisation.

It follows that the needs of the public are the sole arbiter of whether a service is worth while; and the subject matter of all public administration ought to be capable of direct or indirect justification by this principle.

Uses of the Small Port

By all standards of public benefit there can be no doubt the small port deserves more consideration than it sometimes receives. It is essential for coastwise shipping, which provides a very cheap means of transport, particularly for heavy goods. It is true the utility of the small port is largely confined to internal or short sea trade, but it should be borne in mind that this country with its indented coast-line is particularly suitable for waterborne transport. Almost every large centre of population in the United Kingdom is situated at or near the sea. Cheaper transport means delivered goods cost less. For instance, in so far as transport is a large factor in building costs, cheaper transport means cheaper houses reflected in either lower rents or better houses for the same rent. It means cheaper coal. Cheaper delivery of raw materials means manufactured things cost less. In fact, the small port can be justified as capable of serving a public need that exists to-day.

In maintaining and improving the services provided by the small port it is desirable to take a long view into the future. It has been generally agreed that the vast building activities which have resulted in the accumulation and agglomeration of population and industry in a comparatively few large centres have not been in the best interests of the public as a whole, from the point of view of health, town planning, traffic, transport and air-raid precautions.(1) It seems that it is desirable that population and industry should be concentrated in a larger number of medium-sized towns (2) having natural facilities, such as transport. Such facilities exist in the numerous ports which surround the coast of this country and which have been of diminishing importance for the past century, though busy centres of water-borne trade in the days before the advent of steam. For those who are sceptical of the possibility of the revival of the small port, it should be pointed out that the motor ship, which has lowering masts and funnel and less draft in comparison with cargo capacity than the steamship, has already resulted in many inland ports, such as Norwich,(3) reverting to some of their former prosperity. It should also be remembered that some of the ports which are now among the largest in the country were at one time comparatively derelict.(4)

It is not here proposed to deal in detail with the special uses of the small port in times of war and emergency. At the same time, it will be appreciated that accidents, such as collisions in fog, occur at sea from time to time in places where the small ports along the coast are the only haven of refuge. Moreover, accidents sometimes occur blocking the entrance to larger ports. In time of war experience has shown that many of the larger ports are congested with naval and military shipping, and civil cargoes must take their chance of distribution from the smaller ports in the locality. Lastly, the sea is the only indestructible highway, and sea transport in time of war and emergency is likely to provide a comparatively safe and flexible service when road, rail and canal systems are congested and in danger of air attack.(5)

Signs of Decay

A glance at many small ports shows picturesqueness rather than efficiency. Harbours have been allowed to silt up, cranes to become derelict, jetties and warehouses to decay.(6)

The Board of Trade returns for 1855 gave statistics of coastwise traffic for 102 ports, of which no less than 70 are no longer considered of sufficient importance to justify the publication of separate figures and which, so far as they are used at all, are now included under the heading "Other Ports."(7)

Reasons for Decay

The decline of so many of the small ports has in large measure been due to economic factors over which the individual port authorities had no control.(8) In fact, they have fallen into partial or almost complete disuse. To some extent, this has been due to the diversion of traffic from coastwise to rail or road.(9)

Among the reasons beyond the control of the port authorities for the decline in trade of the small port are the following:

1—Undercutting road and rail rates.
2—Neglect of facilities.
3—Deterioration of railway-owned and other canals forming valuable links for water-borne trade between small seaports and inland towns.
4—Heavy stevedoring and dock charges at small railway-owned "local distribution" ports.
5—Tendency at railway-owned ports to attract traffic to be distributed by railway.
6—The maintenance of high cost of short rail haulages for collection and delivery of cargo.

It is clear that numerous interests are vitally concerned and the issues are highly controversial. From the point of view of public administration, however, there can be no other guiding principle than that which is dictated by the needs of the public as a whole. That is to say, it is necessary that everything should be done to bring mankind his daily requisites as cheaply and efficiently as possible. It is not merely necessary that one requisite or one commodity on perhaps rare occasions should arrive with cheapness and efficiency, but the problem should be viewed widely as a whole from the point of view of providing mankind with a free choice of the best transport services.

Historically, it can be shown that competition is the motive power of progress. There can be no doubt of the great benefits mankind owes to the incentive to improve which comes from rivalry. All will admit, however, that there comes a moment when rivalry ceases to confine itself to the provision of better services and takes the form of a more direct attack on the rival with the intent to injure him. It is clear that something of this kind has overtaken many small ports. To meet these difficulties some measure of control must be exercised over all forms of transport to enable the public to enjoy this free choice of the best services. It has been generally understood: 1—that it is undesirable to permit cut-throat competition; 2—that it is open to objection if one form of transport owns docks and harbours to which access is essential by other means of transport; 3—that there should be some co-ordination to a greater or less degree between all forms of transport.

Dealing first with cut-throat competition, it is clear that however much an individual user may gain temporarily from a particular uneconomic transport trade, in the long run the public as a whole must suffer. The essence of the gentle art of rate-cutting is that the particular service shall be designedly run at a loss to put a rival service out of business. This done, the service left in possession of the field has no further incentive to provide uneconomic services and rates. The public thus suffer in three ways. First, the expenditure necessary to run the particular service at a loss has been derived from some other

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(1) See Third Report of the Commissioner for the Special Areas (England and Wales), 1936. (Cmd. 5303, p. 7, para. 21). A Royal Commission is engaged at the present time in inquiring into the causes which have influenced the present geographical distribution of population and industry, and the probable direction of any change in that distribution in the future and in considering what social, economic, and strategical disadvantages arise from the concentration of population and industries in large towns or in particular areas. It is to report what remedial measures, if any, should be taken in the national interest.

(2) See The Report of the Departmental Committee on Garden Cities and Satellite Towns. (Summary of conclusions and recommendations, p. 25, para. 10).

(3) "Norwich and Its Shipping." Speech by Mr. W. J. Everard, Chairman of the British Motor and Sailing Ship Owners' Association, at the Annual Meeting of the Norwich Publicity Association, reported in "Eastern Daily Press," 13th February, 1937.

(4) Defoe's A Tour through England and Wales (1724)—Southampton. "Southampton is a truly antient town, for 'tis in a manner dying with age; the decay of the trade is the real decay of the town; and all the business of moment that is transacted there, is the trade between us the the islands of Jersey and Guernsey, with a little of the wine trade, and much smuggling. The building of ships also is much stop'd of late; however, the town is large, has many people in it, a noble fair High Street, a spacious key; and if its trade should revive, is able to entertain great numbers of people: There is a French church, and no inconsiderable congregation, which was a help to the town, and there are still some merchants who trade to Newfoundland, and to the Streights with fish; but for all other trade, it may be said of Southampton as of other towns, London has eaten it up. The situation of the town between two rivers was to its advantage formerly in point of strength, and the town was wall'd with a very strong wall, strengthen'd with a rampart, and a double ditch: but I do not hear that they ever were put to make much use of them."

(5) See Minutes of Evidence taken before the Royal Commission on Transport, 1929. Evidence of Sir Julian Foley, then Mr. E. J. Foley, C.B.E., Principal Assistant Secretary of the Mercantile Marine Department of the Board of Trade, pp. 794/5, para. 12276.

(6) See The Final Report of the Royal Commission on Transport, 1929, para. 492. See also Minutes of Evidence (ibid.) Memorandum of the Shipowners' Parliamentary Committee, p. 802, para. 42, and Evidence of Sir Norman Hill, p. 809, paras. 12429 et seq.

(7) Ibid., para. 451.

(8) See The Final Report of the Royal Commission on Transport, 1929, para. 452.

(9) See Minutes of Evidence taken before the Royal Commission on Transport, 1929. Memorandum of the Shipowners' Parliamentary Committee, pp. 801, 802, paras. 36 et seq.
Ibid., Evidence of Sir Norman Hill, p. 809, para. 12416.

Administration of Ports—continued

source, such as the profitable services to other places. In this instance, those places served by one form of transport only would be contributing to cheapen the services between places where there are rival forms of transport in competition. Secondly, the rival form of transport being put out of business, the public it formerly served are deprived of that facility. Thirdly, the object of rate-cutting being achieved, the public it served must expect an advance in rates and a deterioration of services.

Applying these principles to the problem of the small port, it can be said that the public have suffered by rate-cutting in rival forms of transport, which has resulted in putting the small port out of business. But it should also be borne in mind that it is just as much against public interests to subsidise small ports as a whole so as to render the service to the public uneconomically low. That does not mean that each port should be equally profit making, for it takes at least two ports (one at each end) to complete a single sea-borne transport service. It is the service as a whole which should be economic.

Turning to the objections to the ownership by one form of transport of docks and harbours to which access is desired by other means of transport, it is not suggested that great changes in ownership are necessary all at once. Administration by an authority, however constituted, is good, provided the administration is good. All that is required is a standard for "good" and a superior authority with default powers to be exercised in the event of that standard not being reached or maintained by the actual dock and harbour owner.

Co-ordination

Lastly, there is the difficult problem of co-ordination. Co-ordination has been defined as "a state in which the various forms of transport—irrespective of ownership—can, under equitable conditions, function efficiently (not only within their several spheres, but also as part of a comprehensive whole) under a system (either imposed or reached by mutual agreement) conditioned by public interest . . . this connotes the carriage of goods by the means of transport which offers the greatest advantages—present and potential—of economy, efficiency, public convenience and national well-being."(10) But having defined co-ordination in terms with which it is hard to quarrel, the difficulties begin. They resolve themselves into applying to the fluctuating and indeterminate assortment of services and rates of all forms of transport, the principles in the definition of co-ordination above referred to. Already, however, considerable headway has been made in service and rate control. Railways, for instance, at their own choice, have long been common carriers. This means they are obliged at common law to accept all ordinary goods brought to them for carriage at proper rates. Railway rates are subject to statutory control, so that goods must be carried either at "standard charges" or at "exceptional rates," or at "agreed charges," the latter being introduced for the first time in 1933. All "exceptional rates" must be reported to the Minister of Transport and, if they are more than 40 per cent. below standard, are subject to supervision by the Railway Rates Tribunal after hearing any representations that may be made from other interests concerned; a somewhat similar procedure applies to "agreed charges." It is not necessary here to enter into the controversy about the effectiveness of the supervision. All railway rates must be published.(11) The majority of road hauliers, on the other hand, are not common carriers. That is to say, they do not as a class hold themselves out to accept all goods that are brought to them for carriage, but pick and choose their loads.(12) Road hauliers are not bound to carry at fixed charges or at all, and need not publish rates. Control, however, is exercised over the services they provide by an authority known as the Traffic Commissioner. No person may use a goods vehicle on a road except under licence from this authority. Objections to the granting of licences can be made by persons already providing facilities by road, railway, sea, canal or air. The grounds of objection are limited, but representations can be made that suitable transport facilities are or would be, if the application were granted, in excess of requirements. It can be objected also that the conditions of the licence, such as fitness of the vehicles, speed limit, weight and loading conditions, conditions of labour and driving hours and keeping of records, have not been complied with.(13) Turning to canals, it will be appreciated that the owners are common carriers, accepting goods for carriage at fixed charges in those cases where they themselves operate the services.(14) But with one or two exceptions, they do not themselves run services, confining their attention to the maintenance of their waterways for the use of independent firms known as bye traders. Bye traders are entirely free from statutory regulation as to the facilities they provide.

Lastly, there is coastwise shipping which is of two distinct kinds. There are the liners which operate regular services and the tramps which, without any fixed port of call, undertake to carry a certain cargo to its destination by special voyage. Co-ordination between liner services and railways does not present great difficulties, and an agreement was arrived at in 1929 between the railway and the liner interests in regard to machinery for discussing and co-ordinating rates.(15) On the other hand, there are obvious and inherent difficulties in trying to apply to tramp services any rate structure capable of being made to conform with that of other forms of transport.

It is clear, however, that unless coastwise shipping, including liner, tramp and port interests, is brought within the framework of a co-ordinated system of transport the fierce competition from which they suffer and the decay of the small port are likely to continue. Every time a port or inland waterway is permitted to silt up or become derelict, it injures the system as a whole. There is one less locality linked to the coastwise transport system. One less field for export coastwise trade. Less trade means ports become still less solvent.

Harbour Authorities

Having considered in general terms the position the small port should occupy in a national system of transport, it is necessary to turn to different kinds of administration existing or desirable in the numerous ports around the coast.

The harbours of Great Britain, with the exception of Holyhead Harbour, which is owned and controlled by the Ministry of Transport, and the Naval ports which are controlled by the Admiralty, are in the hands of local harbour authorities.(16)

Harbour Authorities are usually established by Special Acts of Parliament. The Special Acts generally contain provisions dealing with such matters as the constitution of the harbour authority, dredging and maintenance of the harbour, the maximum rates and charges to be levied, and making of by-laws for the control and regulation of vessels and persons employed in connection therewith, the definition of the limits within which the authority may exercise jurisdiction and demand rates and raising and repayment of capital. Additional powers for the construction of new works, the levying of additional rates or the raising of additional capital are normally only obtainable by the promotion of a further Private Act. The Minister of Transport may, however, authorise particular works not exceeding £100,000 by Provisional Order. Apart from this control, harbour authorities are responsible generally for the working and maintenance of their undertakings.(17)

It will be seen that the nature of the various bodies in which the ownership of small ports is vested is very varied. It would be invidious to suggest that one form has produced better results than others. Some general comments are, however, desirable as suggestions for future legislation.

In the first place, one must deal with the general question of unification of control of all ports under one central authority. It must be conceded at once that worked out on paper there is much to recommend unified control in all forms of transport. On the other hand, it would be bitterly opposed by traders and other transport users who have always looked to the stimulus of competition, if not to carry goods at uneconomical rates, at any rate to secure new methods and new inventions for the improvement of transport. In fact, in transport as in other matters, competition is the mother of invention. It has, therefore, been the policy agreed by the trading interests, the majority of the transport interests, and, indeed, of the report of the Royal Commission on Transport that the public would gain most by control and co-ordination as opposed to unification.(18) Suggestions made here for ideal forms of port ownership exclude, therefore, unification of control of all forms of port ownership under one central authority.

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(10) See invitation issued at the instance of the Chairman of the Transport Advisory Council to submit observations (cited in the Report on Service and Rates, Transport Advisory Council, 1937, p. 31).

(11) Railways Act, 1921, Part III (Railway Charges), Part IV (Wages and Conditions of Service) and 3rd, 4th, 5th, 6th, 7th and 8th Schedules).
Road and Rail Traffic Act, 1933, Part II (Railway Traffic) and 3rd Schedule (repeals).

(12) See Belfast Ropework Co. v. Bushell, 1918, 1 K.B. 210.

(13) Road and Rail Traffic Act, 1933, Part I (Road Traffic). See also Road Haulage Wages (No. 2) Bill, April, 1938.

(14) See Provisional Orders made under the Railway and Canal Traffic Act, 1888.
Railway and Canal Traffic Act, 1854, s. 7.

(15) See Report on Service and Rates, Transport Advisory Council, p. 14.

(16) These authorities can be considered in the following categories:

Authorities	No. of Ports
(i) Local commissions or trusts not working for profit established under statutory authority for the management of particular harbours	110
(ii) Municipal authorities	70
(iii) Railways	50
(iv) Harbour Companies or individuals	100

(17) See Final Report of the Royal Commission on Transport, 1929, paras. 445, 446.

Administration of Ports—continued

It would seem desirable to adopt the public trust not working for profit as the ideal for port ownership. Bodies of this kind are not tied to one local authority (as are the municipally-owned ports). Indeed, it is desirable that such trusts should not be confined to single ports, but should control all the harbours in a particular district. The constitution provided for in the statutes establishing such trusts should provide adequate representation on the governing body for all the interests concerned. Some recent private Acts are good examples of the way in which representation of the various interests is secured.(19) These interests include primarily the local authorities concerned, but it is equally essential that there should be some representation of shipowners and merchants who use the port, but who may or may not be represented on the local government register of electors. As has been said before, it is undesirable that one form of transport should obtain ownership or a controlling interest in docks or harbours to which access is essential by other means of transport. When the dock or harbour authority is a non-profit owning trust the charges should not be more than are required for it to be economically and efficiently managed to meet expenses, including, of course, interest on capital required for new development. It is desirable that such charges should be at a level sufficient to reward the capital invested and to attract new capital when its is reasonably required for developments. It is also desirable that some machinery should exist for the revision from time to time of rates and charges. Here, again, revision should be made in the public interest after consultation with all interested bodies. It is desirable that the Acts establishing port authorities should contain what is commonly known as the standard revision clause, a copy of which is given at the end of this paper.(20)

Port Facilities

It is necessary to say a word on the facilities which harbour authorities should provide in addition to maintenance and repair on structures within their control. First, there must be proper means of approach from the land, such as adequate railways and roads at the quays, or where there is no railway, at any rate, road approach. It is desirable that the attention of highway authorities should be drawn to the need for including in their road policy dock approaches in addition to the normal works to relieve traffic congestion.(21) Then attention should be paid to the needs of loading and unloading, and the principal ports should be provided with modern appliances and labour-saving machinery of all kinds. Coastwise ports should permit of access wherever possible at all states of the tide. Good transit sheds suitable to the requirements of the various trades are needed, and modern cranage equipment to expedite loading and discharging.(22) At smaller ports cranes are often not of an up-to-date type or are out of order.(23) Finally, the warehouse accommodation for goods should be properly supervised. Quayside space is valuable and ought not to be congested with goods placed there for long-term storage.(24)

Dock and stevedoring charges are most important items in the development of the small port. The charges made for loading and discharging a ship often equal the remuneration paid to the ship for a voyage in the Home Trade. Time is an all-important factor in the cost of sea transport, and so appliances that are old and slow add to the cost of the transaction and have a cumulative adverse effect upon the development of the small port.

Generally speaking, privately-owned wharves and docks have done their best to bring themselves up to date. At Ford's Works, Dagenham, they discharge a ship with 8,000 tons of iron ore in 48 hours. The Lancashire Steel Corporation of Irlam can come near to equalling this, and other private wharves approach it, but the average of railway ports or dock authorities is nearer 1,000 to 1,500 tons per day.

We have to turn to Rotterdam, however, for the finest discharging facilities in the world. There they guarantee to turn out certain ore-laden ships at the rate of 7,000 tons per day. I am not suggesting that the small ports can or should aim so high, but I do submit that it helps to illustrate my point. Speed makes for cheap handling of goods, and for cheap freight—two essential factors in sea transport.

Conclusion

In bringing this brief review to a close, I would emphasise that enthusiasm and drive, rather than any specific type of administration, are required to restore, maintain and improve the heritage of the chain of small ports round our coasts, on which a comprehensive coastwise transport system is based. In the great ages of the past, statesmen have come forward to urge the call of small ports. I need not dwell upon the great pains taken by Queen Elizabeth's Secretary of State to construct harbours along the coasts of England and Wales, except to say that the form of the authority counted less than the personnel.(25) Success came from the will to get things done. It is true that we are better served to-day by transport services of all kinds than little more than a century ago, when Cobbett wrote of the miseries of labourers in inland districts, who ate their food uncooked for want of fuel.(26) The incentive for well-directed public works remains. Cheap transport is essential if the standard of living is to be raised by the provision of better housing and amenities, electricity in rural districts, good roads, and so forth. All these require the carriage of coal, bricks, cement, stone and timber, and coastwise transport is the economical instrument if the ports are available for distribution. In an age, therefore, when sail has given way to steam, steam to oil, and the oldest form of transport has been supplemented by railways, motor cars and aeroplanes, the essential motive power which draws us nearer to Utopia is still the same. It is zeal and activity for work of public benefit for our people, and a good measure of these is to sought from the public-spirited men who serve on our port authorities.

"There is no one thing (most renowned Sovereign)," Sir Walter Raleigh said to Queen Elizabeth, "of greater necessity to maintain the honour and safety of this your Majesty's realm, than by all convenient means to increase Navigation, Shipping and Mariners, these being a strength in time of war; and in time of peace, members most profitable and commodious.

"But this can neither be had, increased, nor maintained, if, first; sure harbours be not provided . . .

"There wanteth nothing but a harbour; which when compassed, all other parts of peopling, wealth, and strength, will follow of itself.

"A marvellous number of poor people both by this work, till the haven is made, and after by the shipping, fishing, etc., will be employed, who now for want of work are whipped, marked and hanged.

"The quick uttering of commodities, which always followeth by increase of intercourse, will cause all the coast and shire to be notably manured and peopled; not with poor, idle, but painful, industrious and rich persons, a great ornament and commodity in peace, and sure defence in war."(27)

Appendix

Standard Revision Clause

1.—If it is represented by application in writing to the Minister of Transport (in this section referred to as "the Minister")

(a) by any chamber of commerce or shipping or any representative body of traders or any person who, in the opinion of the Minister, is a proper person for the purpose, or

(b) by the (Undertaking)

that under the circumstances then existing the authorised rates or any of them should be revised the Minister, if he thinks fit, may make an order revising the authorised rates referred to in the application or any of them, and may fix the date as from which such order shall take effect, and thenceforth such order shall remain in force until the same expires or is revoked or modified by a further order of the Minister made in pursuance of this section.

2.—An application made to the Minister under this section shall be accompanied by such information and particulars as the Minister may consider relevant certified in such manner as he may require.

3.—Where upon an application for revision of authorised rates or an authorised rate an order has been made or the Minister has decided not to make an order, no further application for a revision of the rates or rate to which the application related

(18) See Final Report of the Royal Commission on Transport, paras. 534, 535.

(19) Pier and Harbour Order (Fowey) Confirmation Act, 1937. 1 Edw. 8 and 1 Geo. 6 (Ch. LXXII), s. 8 (as to appointment and election of commissioners).

(20) See Appendix.

(21) See the Final Report of the Royal Commission on Transport, 1929, para. 469; and also Highways Development Survey, 1937 (Greater London) "Bressey Report," paras. 5, 29/32, and Appendix

(22) See Chamber of Shipping Port Facilities Report, 1929, pp. 23/24.

(23) See Final Report of Royal Commission on Transport, 1929, para. 492.

(24) Memorandum of Shipowners' Parliamentary Committee, Minutes of Evidence taken before Royal Commission on Transport, 1929, p. 800, para. 23.

(25) Thomas Cecil, afterwards Lord Burleigh. Cecil's first proceeding was to inquire into the state of the harbours. On the information thus received a warrant was issued for Commissioners under the Great Seal for the superintendence and care of ports and havens. Considerable ingenuity was shown in devising expedients to raise money for the repair of harbours. But that which most engaged the attention of the Secretary of State was the personnel of the Commissioners; for the list of names for the several Counties in England and Wales exists to-day, much revised, in Cecil's own handwriting. S.P.D. El. XXXVII, 47, 49. See also Cunningham, Growth of English History and Commerce, Modern Times, Part I, p. 66.

(26) Cobbett's Rural Rides (1822). Everyman Edition, Vo. I, p. 58.

(27) Sir Walter Raleigh: A Discourse of Sea Ports. See Harleian Miscellany, 1809, Vol. IV, p. 305.

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shall be made within twelve months from the date of such order or decision, as the case may be.

4.—Before making an order under sub-section (1) of this section the Minister shall cause an inquiry to be held in reference thereto, and sub-sections (2) to (5) of section 290 of the Local Government Act, 1933, shall apply to such inquiry as if it were an inquiry held in pursuance of sub-section (1) of that section and the (Undertaking) were a local authority.

Provided that the person appointed to hold the inquiry shall be the rates advisory committee constituted under the Ministry of Transport Act, 1919, or any sub-committee thereof to which the said advisory committee may under section 2 of the Harbours, Docks and Piers (Temporary Increase of Charges) Act, 1920, have delegated their powers, or if the said advisory committee cease to exist some persons with similar qualifications to be appointed for the purpose by the Minister.

The Mittel-land Canal

A Notable German Undertaking

The opening of the Mittel-land (Midland) Canal in Germany on October 30th, marked the culmination of a great scheme of internal navigation in that country connecting the important natural traffic waterways of the Oder, the Elbe, the Weser and the Rhine, and placing Berlin in the East in direct communication by water with the Western industrial region of Westphalia. Craft of one thousand tons carrying capacity (29½-ft. broad and 6½-ft. draught) can now reach Berlin from the North Sea, and there is a serviceable route from the capital as far as Basle or Emden on the western side and eastwards into Silesia, as far as Breslau, or along the River Oder to the Baltic. In due course, according to present arrangements, that is to say, in about five years' time, when the Rhine-Main-Danube Canal is completed, the system of internal waterways will stretch right across Europe to the Black Sea.

The scheme, of which the Midland Canal forms the last, though central, link, had been envisaged as far back as the 16th century, and part of the present network is the creation, or at any rate the promotion, of Frederick the Great of Prussia during the 18th century. Altogether, its ramifications throughout Germany extend to almost seven thousand miles, from East to West, including subsidiary branches. The Midland Canal itself, the construction of which has occupied about 50 years, is just under 300 miles in length, and it extends from Madeburg, where the opening ceremony was performed by Herr Rudolf Hess, Deputy of the Fuehrer, to Dortmund, where two nearly parallel branches link up with Dursburg and Wesel respectively. It passes through Brunswick, the headquarters of the Reichswerke Hermann Goering, the great State ironworks. The important Fallersleben motor car factory site is also joined to the canal by a short branch. From Brunswick, the canal route continues Westward to Hannover, and on through Minden to the junction with the Dortmund-Ems Canal; thence through Muenster to its termination at the junction with the Rhine. Throughout its course, the canal comprises a series of sectional elements, known respectively as the Weser-Elbe Canal, the Ems-Weser Canal, the Dortmund Ems Canal, and the Rhine-Herne Canal.

Among the more notable engineering features of the undertaking are the twin locks at Anderten, near Hannover, with a rise (or fall) of 15 metres (50-ft.), and the mechanical lift at Rothensee (Magdeburg) with a range of 18 metres (about 60-ft.).

Book Reviews

Baugrund und Bauwerk (" Foundations and Structures "), by F. Koegler and H. Scheidig. Pp. 288, with diagrams and illustrations. Export price: 16.50 marks in paper; 17.65 marks bound. Berlin, 1938: Wilhelm Ernst & Son.

This is an excellent book, including the most recent theory and practice of foundations. It is to be hoped that it will be translated, as, apart from the proceedings of the 1936 Harvard Conference on Soil Mechanics, there is not yet in English a good text on the remarkable results which have resulted from Terzaghi's pioneer work.

The present book deals with the necessity, methods and time required for the investigation of foundations, the geological and hydrological factors, the examination of sites, the properties of soils, the magnitudes of settlements under loads, permissible loadings, the reaction of the foundation on the superstructure, cracks, pile foundations, freezing of the soil and its effects, and, lastly, legal questions arising out of foundation failures.

As far as harbour matters are concerned this book is of great value. It deals in considerable detail with subsidence, pile support, reaction of new buildings on old ones, the bending and cracking of long buildings due to unequal settlement, the stability of piers and bridge abutments and a hundred other problems which are continually arising in port practice. Particular attention is given to the difficulties of the lateral expansion of foundations, the squeezing out of soft layers, rigid and flexible bases, settlement on mixed soils, and earth banks on soft soils. Practical guidance is given on the measurement of settlements and the bearing capacity of various kinds of foundation.

There is also included a masterly and concise exposition of the Terzaghi theories of soil mechanics which have proved so fruitful in practice. H. C.

Surveying and Field Work, by Jas. Williamson. Second revised and enlarged edition. Pp. XXVI. + 492, with illustrations, folder-plates and diagrams. Price 20s. net. London, 1938: Constable & Co.

There are, of course, a number of excellent books published on surveying, levelling and geodesy generally, but the second edition of Mr. Williamson's text book is by no means a superfluous addition to the number. It is a clear and serviceable account of all the instruments used and the operations carried out in connection with survey work. Compared with the earlier edition, there has been some curtailment of the more elementary matter with a re-arrangement of the chapters, and, in compensation for the excisions, a new section on Tacheometric Surveying has been added. The work in its revised form is quite up to date, and covers the basic principles of surveying work by means of chain, compass, sextant and theodolite, either separately or in combination. In an appendix are given a series of useful geometrical and mathematical tables. Two folder-plates relate to a simplified tacheometric method. There is a bibliography of recent works on the subject and a serviceable index. The book is well printed and the diagrams are clear.

Lloyd's Register Annual Report.

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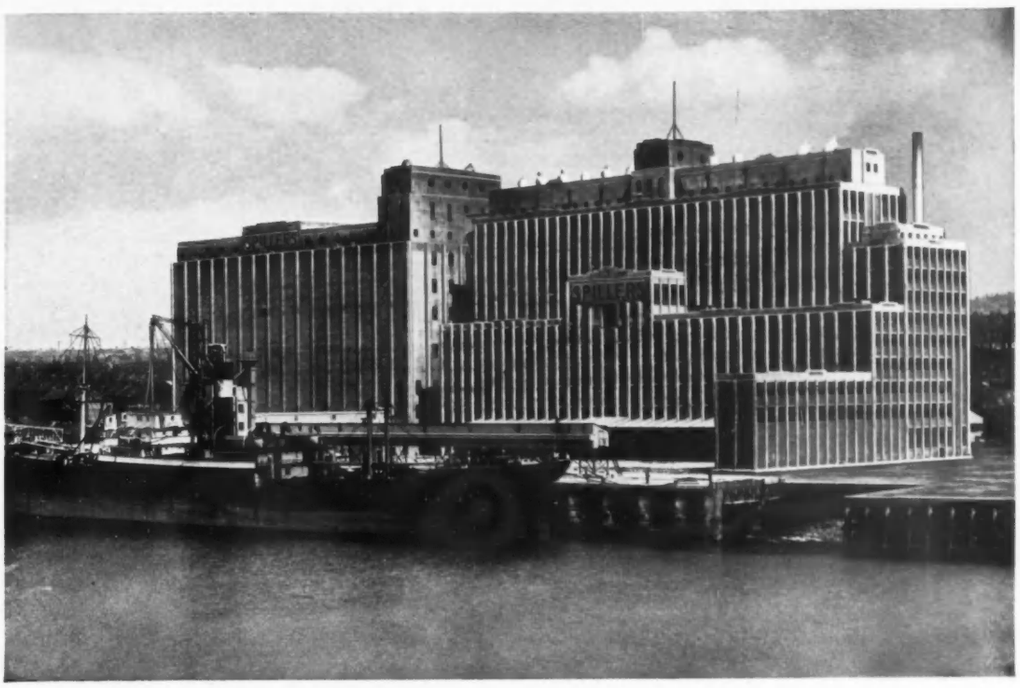

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Administration of Ports—continued

shall be made within twelve months from the date of such order or decision, as the case may be.

4.—Before making an order under sub-section (1) of this section the Minister shall cause an inquiry to be held in reference thereto, and sub-sections (2) to (5) of section 290 of the Local Government Act, 1933, shall apply to such inquiry as if it were an inquiry held in pursuance of sub-section (1) of that section and the (Undertaking) were a local authority.

Provided that the person appointed to hold the inquiry shall be the rates advisory committee constituted under the Ministry of Transport Act, 1919, or any sub-committee thereof to which the said advisory committee may under section 2 of the Harbours, Docks and Piers (Temporary Increase of Charges) Act, 1920, have delegated their powers, or if the said advisory committee cease to exist some persons with similar qualifications to be appointed for the purpose by the Minister.

The Mittel-land Canal

A Notable German Undertaking

The opening of the Mittel-land (Midland) Canal in Germany on October 30th, marked the culmination of a great scheme of internal navigation in that country connecting the important natural traffic waterways of the Oder, the Elbe, the Weser and the Rhine, and placing Berlin in the East in direct communication by water with the Western industrial region of Westphalia. Craft of one thousand tons carrying capacity (29⅕-ft. broad and 6½-ft. draught) can now reach Berlin from the North Sea, and there is a serviceable route from the capital as far as Basle or Emden on the western side and eastwards into Silesia, as far as Breslau, or along the River Oder to the Baltic. In due course, according to present arrangements, that is to say, in about five years' time, when the Rhine-Main-Danube Canal is completed, the system of internal waterways will stretch right across Europe to the Black Sea.

The scheme, of which the Midland Canal forms the last, though central, link, had been envisaged as far back as the 16th century, and part of the present network is the creation, or at any rate the promotion, of Frederick the Great of Prussia during the 18th century. Altogether, its ramifications throughout Germany extend to almost seven thousand miles, from East to West, including subsidiary branches. The Midland Canal itself, the construction of which has occupied about 50 years, is just under 300 miles in length, and it extends from Madeburg, where the opening ceremony was performed by Herr Rudolf Hess, Deputy of the Fuehrer, to Dortmund, where two nearly parallel branches link up with Dursburg and Wesel respectively. It passes through Brunswick, the headquarters of the Reichswerke Hermann Goering, the great State ironworks. The important Fallersleben motor car factory site is also joined to the canal by a short branch. From Brunswick, the canal route continues Westward to Hannover, and on through Minden to the junction with the Dortmund-Ems Canal; thence through Muenster to its termination at the junction with the Rhine. Throughout its course, the canal comprises a series of sectional elements, known respectively as the Weser-Elbe Canal, the Ems-Weser Canal, the Dortmund Ems Canal, and the Rhine-Herne Canal.

Among the more notable engineering features of the undertaking are the twin locks at Anderten, near Hannover, with a rise (or fall) of 15 metres (50-ft.), and the mechanical lift at Rothensee (Magdeburg) with a range of 18 metres (about 60-ft.).

Book Reviews

Baugrund und Bauwerk (" Foundations and Structures "), by F. Koegler and H. Scheidig. Pp. 288, with diagrams and illustrations. Export price: 16.50 marks in paper; 17.65 marks bound. Berlin, 1938: Wilhelm Ernst & Son.

This is an excellent book, including the most recent theory and practice of foundations. It is to be hoped that it will be translated, as, apart from the proceedings of the 1936 Harvard Conference on Soil Mechanics, there is not yet in English a good text on the remarkable results which have resulted from Terzaghi's pioneer work.

The present book deals with the necessity, methods and time required for the investigation of foundations, the geological and hydrological factors, the examination of sites, the properties of soils, the magnitudes of settlements under loads, permissible loadings, the reaction of the foundation on the superstructure, cracks, pile foundations, freezing of the soil and its effects, and, lastly, legal questions arising out of foundation failures.

As far as harbour matters are concerned this book is of great value. It deals in considerable detail with subsidence, pile support, reaction of new buildings on old ones, the bending and cracking of long buildings due to unequal settlement, the stability of piers and bridge abutments and a hundred other problems which are continually arising in port practice. Particular attention is given to the difficulties of the lateral expansion of foundations, the squeezing out of soft layers, rigid and flexible bases, settlement on mixed soils, and earth banks on soft soils. Practical guidance is given on the measurement of settlements and the bearing capacity of various kinds of foundation.

There is also included a masterly and concise exposition of the Terzaghi theories of soil mechanics which have proved so fruitful in practice. H. C.

Surveying and Field Work, by Jas. Williamson. Second revised and enlarged edition. Pp. XXVI. + 492, with illustrations, folder-plates and diagrams. Price 20s. net. London, 1938: Constable & Co.

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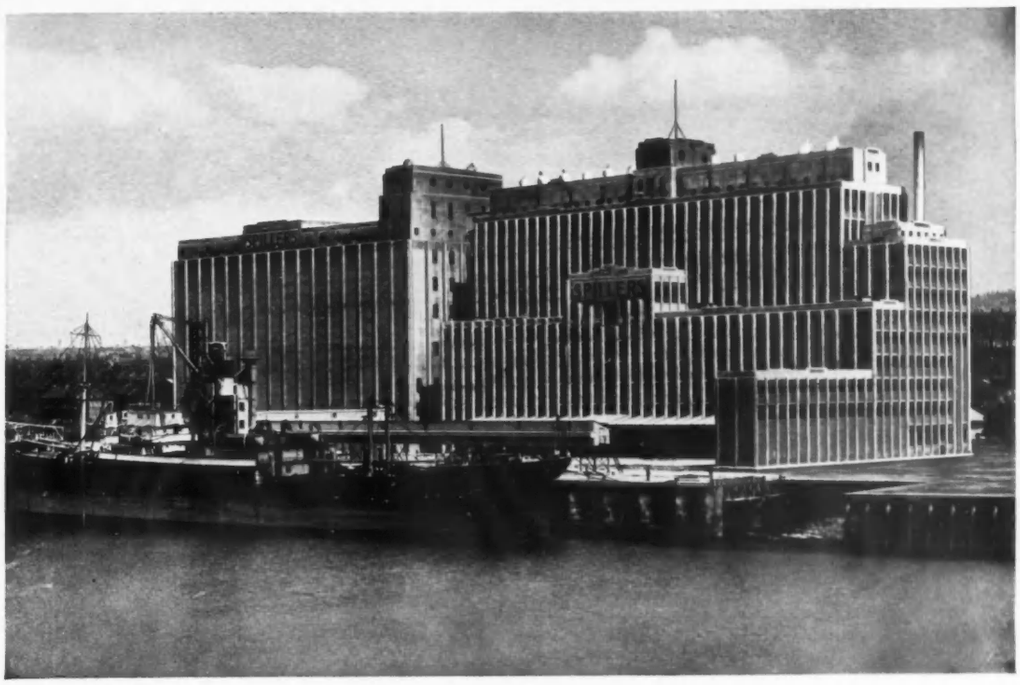

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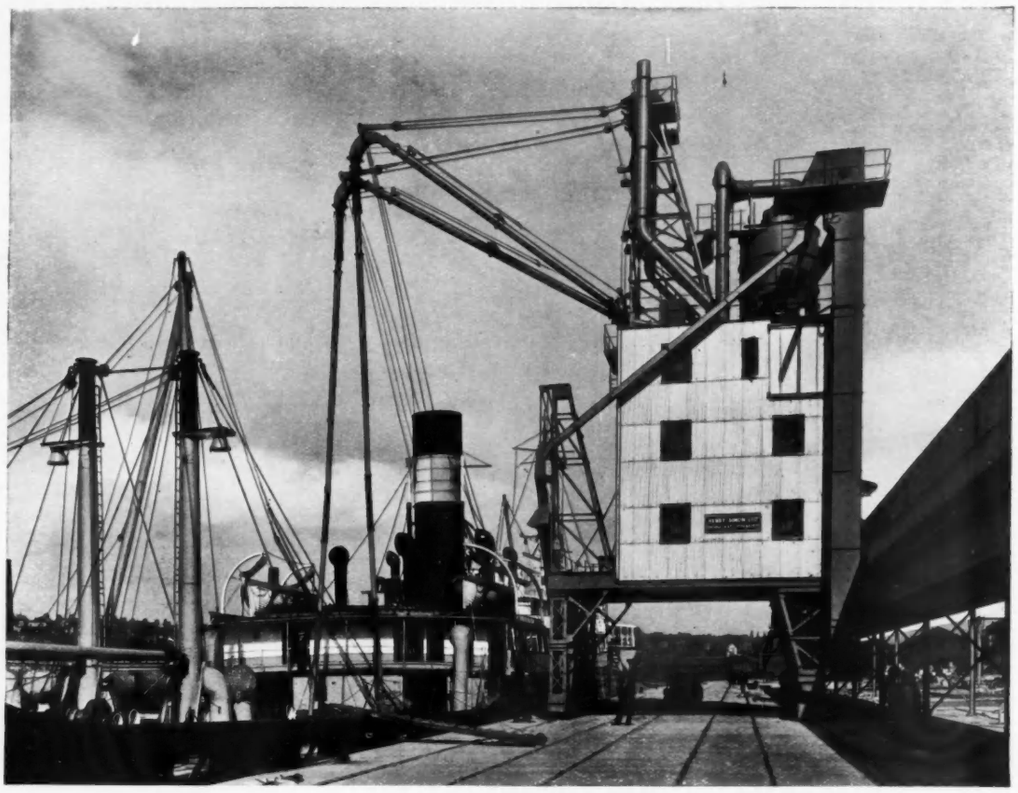
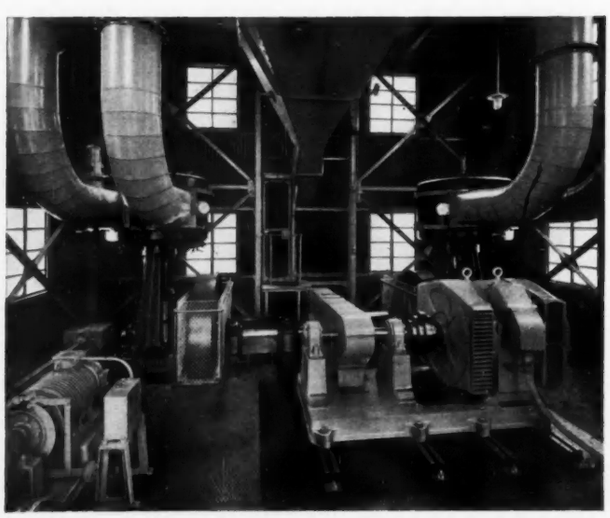


"Simon" Travelling Pneumatic Grain Discharging Plant on the Quay in front of the Mill

The portal frame of the travelling structure is of sufficient span to allow two sets of railway lines to pass between. The plant travels on rails at 27-ft. 6-in. centres, which are also used for the dockside cranes.

The portal frame is of substantial braced steel construction, 16-ft. 6-in. from the rail to the floor level, the front support being steel columns carried on single cast-steel runner wheels at 20-ft. 9-in. centres. The back support is of heavier construction of the tapered type, each column being supported on double bogie wheels, one set being geared for traversing, as is the case with one of the front wheels. This bogie frame carries the main weight of the machinery, including the vacuum pumps.

The main pump floor forming the top of the portal frame is constructed of 20-in. joists securely braced and plated to form a rigid floor for the machinery. On this floor is mounted a braced steel structure, covered with Robertson's protected metal, and at a height of 18-ft. from the pump floor is built a platform for carrying the tipper seal, dust seals and the winch for operating the pipe booms. At a height of 8-ft. 6-in. above the tipper floor is the weather deck, and this is cambered and supports the receiver, cyclone, crane post carrying the pipe booms, and the loading-out elevator with its driving gear.



Two electrically-driven Vacuum Pumps arranged in the Tower of the Pneumatic Plant

The pumps are of the Simon standard double 14a reciprocating type, and each unit is flexibly mounted and balanced in such a way so as to avoid vibration. The driving gear is by Renold chain, which is flexible mounted between the two pumps, so that any possible distortion of the structure will not affect the smooth running of the machine. These pumps are driven by 180-h.p. motor at 585 revs. per minute.

Each pump is fitted with a relief valve and vacuum gauge, and is provided with mechanical lubrication for the reciprocating parts and ring oiling for the main bearings, and a special system of dry lubrication for the piston rings.

The grain and air unit forming the receiver is of heavy construction steel plate. Inside this unit is an internal cyclone with adjustable inlet, in which is extracted the bulk of the dust in transit. A secondary cyclone of heavy construction is fitted outside the grain-receiving unit, and retains the beeswing and other light matter which pass the first cyclone.

The grain-receiving unit and cyclones are fitted at their extremities with the usual air seals, the one under the grain outlet being of the well-known tipper seal pattern, with driving gear which renders it impossible for pieces of rope, wood or iron picked up with the grain to damage the seal or obstruct the working of the plant. This machine is encased in a light steel housing with access doors. The dust outlet points are provided with rotary seals.

The two grain-handling pipes are carried from a crane post, mounted on top of the main structure, two connecting pipes being fitted from the swivel joints to the grain receiver. Below the rectangular bends are flexible sections, attached to which are two 18-ft. lengths of telescopic section fitted with automatic air-tight glands.

Below the telescopes are flexible and steel portable pipes with quick coupling flanges, terminating in a "Reform" intake nozzle, which can be of the camel-back type for general work or of the vertical sinking type. Experience has shown that with the sinking nozzle there is an increase in efficiency of from 5 per cent. to 10 per cent., but for cleaning up it is usual to change to the camel-back type.

The pipe booms can be slewed, luffed and telescoped, thus providing every facility for quick discharge of grain in the holds of vessels, and all movements are controlled by flexible wire ropes carried through guide pulleys and terminating at the winch drums.

The winch is of the four-drum pattern, automatic type, fitted with friction clutches, worm gear and solenoid brakes, driven by a 7-h.p .motor. A man on the ship controls, with a master controller, each movement from the most advantageous position over the ship's hold where every movement can be observed.

New Quayside Flour Mill at Newcastle-on-Tyne—continued

An automatic contact is provided in the grain hopper underneath the tipper, so that should this become full, through any mischance, the pumps are immediately stopped. The conveyors in the gantries also are provided with emergency stop buttons which can be operated from any point.

The traversing gear for the plant is operated by a 20-h.p. motor through machine-cut steel gearing, the speed of traverse being 50-ft. per minute.

The electrical equipment was included in Messrs. Simon's contract, together with the lighting for the travelling plant and the conveyor gantries.

The plant receives supply from an overhead conductor system comprising three special alloy conductors, the conductors being guarded by an enclosure of Robertson's protected metal sheeting, which is built as part of the gantry steelwork and covering. The various lengths of the special alloy are bonded together at the joints, and pilot lights are connected at two points on the conductor system to show when the latter is "alive." The collector gear on the traverser is of special design to deal with the full load at stand-still and with sufficient flexibility to cover normal track irregularities.

The supply from the collector gear on the traversing plant is led to a switchboard, consisting of a main isolating switch and starter for the pump motor, and switch-fuse units, supplying respectively the auxiliary motors and the lighting transformer.

Grain discharged by the pneumatic plant is delivered to conveyors arranged in a gantry on the quay, and thence to two cross conveyors leading to the silo. The quay conveyor gantry is 278-ft. long to the junction house, and the cross gantry is 128-ft. long. Provision is made at the junction house for a future extension of the quay gantry. The gantries and conveyors were supplied by Henry Simon, Ltd.

View in the Tower of the Pneumatic Plant, showing the tipper seal, and winches controlling the Pipe booms

The Silo

The total capacity of the silo is over 150,000 quarters of wheat. It is of reinforced concrete constructed on the sliding shuttering principle. It is 168-ft. to the top of the elevator tower, is 224-ft. long and 84-ft. wide. The walls of the storage section of the silo are relieved by narrow columns running from ground level to immediately below the operating floor over the bins. This floor, and the upper portion of the working house, are set back slightly—an arrangement which adds very definitely to the pleasing appearance of the massive structure. The round windows, which have been incorporated in the design of the upper portion of the building, are a notable architectural feature and enhance the general appearance of the whole. At the end nearest to the main mill building is the working-house accommodating the receiving and discharging elevators, weighers, preliminary cleaning plant and other operating machinery. This section comprises eleven floors, and is surmounted by a tower arranged across the full width of the structure, and here again round windows have been used effectively. All floors are well lit by large area steel-framed windows, and two bridges are provided between the working-house and the main mill building. An electric lift serves all floors, and there is also a concrete staircase.

Grain discharged by the pneumatic plants is delivered via the gantry conveyors on the quay to the basement of the working-house, and passed to the elevators feeding two Avery 2-ton automatic weighers fitted with instantaneous balance and residue weighing equipment. After weighing, the grain is passed over a rubble separator and then delivered to the three band conveyors on the distributing floor above the bins. These conveyors, which have a capacity of 150 tons per hour each, are provided with travelling throw-off carriages, whereby the grain is delivered to any of the storage bins.

In the silo basement are the bin hoppers operated by rack and pinion, and three 100-ton conveyors for discharging the bins, and feeding either to the wheat-cleaning department or the provender mill, or for transferring grain as required from bin to bin. All grain leaving the silo is again weighed, and after passing over a ravelling reel is sent by bulk chain conveyors across the top gantry to the bins in the wheat-cleaning department of the flour mill or to bins in the provender mill as required.

Intermediate bins are provided in the silo for bulk loading to rail or road vehicles, and facilities are also available for sacking-off.

The Main Mill Building

All the buildings are designed on dignified lines without unnecessary ornamentation, but flat surfaces have been skilfully broken up by the use of bold columns and the setting back of the portion of the block occupied by the milling plant and the employment of an all-concrete narrower top section are notable architectural features which play an important part in the design. The building is surmounted by a concrete tower similar in outline to the tower of the silo.

The building is constructed of concrete columns and beams with red brick panels above and below the lines of large steel-framed windows. The brickwork panels form a relief to the main concrete construction, and give a lighter and more pleasing effect than could be obtained with an all-concrete building.

The Warehouse

The warehouse comprises the first five floors of the main building, all packing being carried out on the two top floors—that is, immediately below the flour mill. The packers are conveniently situated for the disposal of the products. Four Simon double spiral sack chutes running the full height of the warehouse provide rapid access to all floors for storage and to the sack band conveyors delivering to the loading-out points. These conveyors are fitted with sack spacers, counters, and separate motor drive and feed either the road or rail-loading platforms. The accommodation provided in the warehouse is very extensive, and all floors are well lighted by large windows on both sides.

The buildings have been set back from the quay so as to provide a wide loading space for road vehicles on the quay side. Three railway tracks are arranged on the land side, and concrete roadways are provided on all four sides.

A.R.P. River Emergency Services in the Port of London

Among the many A.R.P. measures taken by the Port of London Authority has been the formation of a River Emergency Service. Volunteers were recruited from amongst owners of river craft and riverside workers in sufficient numbers to put the scheme into operation on October 1st had the necessity arisen.

Details of the organisation have been reconsidered in the light of experience and proposals to meet possible future requirements were explained at a meeting presided over by Mr. Sidney Clough and held recently at the headquarters of the Yacht and Motor Boat Association. Rear-Admiral R. W. Oldham, O.B.E., Air Raid Precautions Officer of the Port of London Authority, was the principal speaker. He stressed the importance of the River Thames as a highway for many emergency services in time of rescue work, fire fighting, repair parties, decontamination work and the maintenance of communications between headquarters and shipping, the docks and key points of the many important business associations on the river.

Twenty-four stations on the river have been selected as bases for the services which require a minimum complement of about 400 men. Men experienced in handling motor boats or with knowledge of first aid or signalling are still required and volunteers will be trained in anti-gas measures and first aid if desired. Numerous craft have been made available but more speed boats and motor cabin cruisers are needed.

Admiral Oldham paid tribute to the many volunteers who have already offered their services and expressed the Port Authority's appreciation of the valuable co-operation of various Associations. He instanced the Royal Ocean Racing Club, the R.N.V.R. (Auxiliary Patrol) Club, the Little Ship Club and finally tendered thanks to the Yacht and Motor Boat Association for their valuable help, particularly in sponsoring the meeting.

Correspondence

From Mr. D. Ross-Johnson, C.B.E., M.Inst.T.

To the Editor of The Dock and Harbour Authority.

The Ports and the Crisis

Sir,—Since the crisis there has in Parliament and in the Press been a very general stocktaking. Nearly every branch of national activity in connection with defence has been under criticism, much of it destructive but tending, on the whole, it may be hoped, to meet the weak points before the next emergency. But there has been one exception. No reference has appeared in the Press to the preparations in the country's ports. Perhaps the explanation is that the period of immediate danger was too short for the emergency organisation intended for the ports to come into effect and for the weaknesses to become apparent. Nevertheless, there would seem to be some room for anxiety both as to whether the measures so far taken go far enough and whether they are sufficiently watertight.

Your Journal has, in the last few months, contained articles and editorial comments calculated to remind the authorities of the need to provide against weaknesses experienced in the last war and to point out some of the problems which have emerged since. These seemed to have been taken to heart by the Government. Certain announcements were made in Parliament by the Minister for the Co-ordination of Defence in the course of the debate on the Defence programme, of which a summary will be found on p. 158 of the issue of your Journal for April last, wherein Sir Thomas Inskip expressed the intention to establish at each of the principal commercial ports of the country a Port Emergency Committee . . . comprising representatives of the many interests using the port, and stated that the Port Authorities, thus placed in possession of the various demands on their resources, would continue the normal executive control of their working. So far so good, but this must be subject, as was pointed out at the time, to the overriding condition that the military authorities, with whom in war time the ultimate authority must rest, would recognise the principle and allow the organisation to function.

It was observed that the representatives of the canals were included in the membership of the Port Emergency Committees, but neither from the Minister nor from any other source has yet come any indication that steps have been taken to put the canals into a condition to function effectively in the period of stress.

Readers who have followed the previous articles on this question, will remember the importance attached to restoring the physical condition of the canals and improving their capacity so that they would be able to conduct the transport of imported foodstuffs between the ports and the intended inland storage depots largely independent of roads and railways.

The Editorial comment on the Minister's speech above referred to in the issue of April, was as follows:—

> " The nation must not be allowed to lull itself into complacency and a false sense of security. The arrangements, enterprisingly undertaken and efficiently begun, must be perfected and extended, for there is still abundant scope for a continuance of effort in the safeguarding of trade and food supplies in time of war. The questions of storage and of inland transport are no less important than the efficient operation of ports. And here again we may be permitted to remind our readers of the plea which has been urged for action on the part of the Government in reviving and extending the use of British canals and inland waterways."

Six months has passed since the above was written and its importance has been emphasised in the interval.

Lord Howe, the Chairman of the British Road Federation. writing to *The Times* on the 28th October, protested in effect that road transport could not cope with the distribution of food supplies from the West Coast ports in addition to military and evacuation demands. In the House of Lords, on the 2nd November, Lord Plumer asked for very elaborate additions in the form of " sidings " and shelter trenches for military traffic, on the roads. We need not accept all these arguments at their face value and certainly not the underlying assumption that the railways can be ruled out as still the most substantial element in the transport machine, but it may be taken as evident that heavy expenditure in some form is before the country to provide for the saisfactory distribution of our food supplies.

And this brings us back to the question of the canals. In previous articles it has been shown how the canal system of the country, if put in order, could cope with the major portion of the problem of food distribution. It may be hoped that the responsible ministers have already given more attention to this side of their programme than their public utterances indicate. If not, they should again be urged seriously to consider it.

Every Canal Authority in the country must already be in possession of surveys of their waterways. Most of them doubtless have the schemes worked out for their improvement which finance only has prevented them from carrying out. They are all members of an Association in which all the information could be assembled. It would not be a lengthy, or difficult, matter to obtain working plans and estimates from which the total cost could be obtained. It is highly probable that the figure would be a fraction of the money proposed to be spent on the roads. And it would decide the question if it would be " good business " to provide a means by which a war-time Ministry of Food could keep all parts of the country supplied free from the danger of interference from other overriding demands of defence. And those other departments should equally welcome the removal of an important and material cause of obstruction to their operations.

The demand on man power of the two methods is also a matter worthy of consideration. A canal boat load (whether the 35-ton or the 100-ton type) requires the same number of men as the 3 or 10-ton lorry. And the boats can be worked by men (often with their wives to help them) who could not pass the physical test required from road operators. Also it takes less labour to discharge goods direct to canal boats or coasting craft than to handle them on the quay, and then to rail or lorry.

But the whole question of labour supply under war conditions, the first of which is that the requirements are extremely fluctuating, is a very difficult one and needs careful prior arrangements. It is a delusion to think that dock labour is mobile. On the contrary, it is very difficult to move from its accustomed groove. This is due partly to ingrained habit and also to the lodging question. In the recent debates on rearmament it has been stated that it has been decided to take the new factories to where the labour is living and not to try to move the labour to new sites. But, of course, this cannot be done in the case of dock labour. In the later phases of the last war after conscription, " Dockers Battalions " were raised and transferred from ports to ports where any serious but temporary shortage of labour arose. If the National Register now being talked of should materialise a system of voluntary " Dockers Battalions " might be organised. But it would want a good deal of organising. This is only mentioned in passing.

Memories are short, and it would be helpful to reperuse the paper by Mr. Geo. Cadbury, read before the Institute of Transport and reproduced in your Journal, on the " Economic Future of Canals," and especially those sections in which the author gave reasoned arguments how the standard could be improved of such canal termini as Leeds, Manchester, York, Norwich, Darlington, Stafford and Worcester. These could again be used as inland ports comparable to many of those on the Continent, which modern seagoing coasting vessels with their small draft, could enter. These canal ports would thus be in easy communication with the principal ports of the Kingdom dealing with the trans-ocean trade and, of course, the vessels carrying on this trade with their shallow draft could generally travel within territorial waters and so be largely immune from the submarine peril. But, as the author pointed out, a necessary condition precedent is the reform of ownership and methods of administration and operation of the Inland waterways. Mr. Cadbury suggested a combined Catchment Board and Navigation Board for each group, under whose statutory powers the funds needed for restoration and development could be obtained by Government grant or guarantee. This is an alternative to the Public Trusts proposed by the previous Royal Commissions. It is for the Government or Parliament to decide on the best method. The important point in the present emergency is that those waterways which form parts of through routes should be brought under one control and be made efficient.

In his statement to Parliament last March Sir Thomas Inskip is reported to have concluded in the following terms:—

" What was needed was a proper consideration of the increased demands which might be made on the ports. No doubt a good deal of traffic would have to be diverted from East Coast to West Coast ports. Was there enough quay space? Was the rolling stock likely to be adequate? Were the railway sidings laid out in a proper way? Was labour likely to be forthcoming? The whole of these necessities had been borne in mind and calculations had been made which enabled him to say that when the arrangements as a whole had been made in the ports there was capacity there to handle any traffic which might be needed "

Without questioning the sincerity of this belief, it would be reassuring if the public could be taken into the confidence of the Government without disclosing information of importance. The whole question would seem to turn on the phrase, " when the arrangements as a whole have been made in the ports." Have these arrangements been completed and has proper allowance been made for the conflicting claims of other departments of defence and for the inland transport of the anticipated abnormal quantities of traffic, and their changed routing?

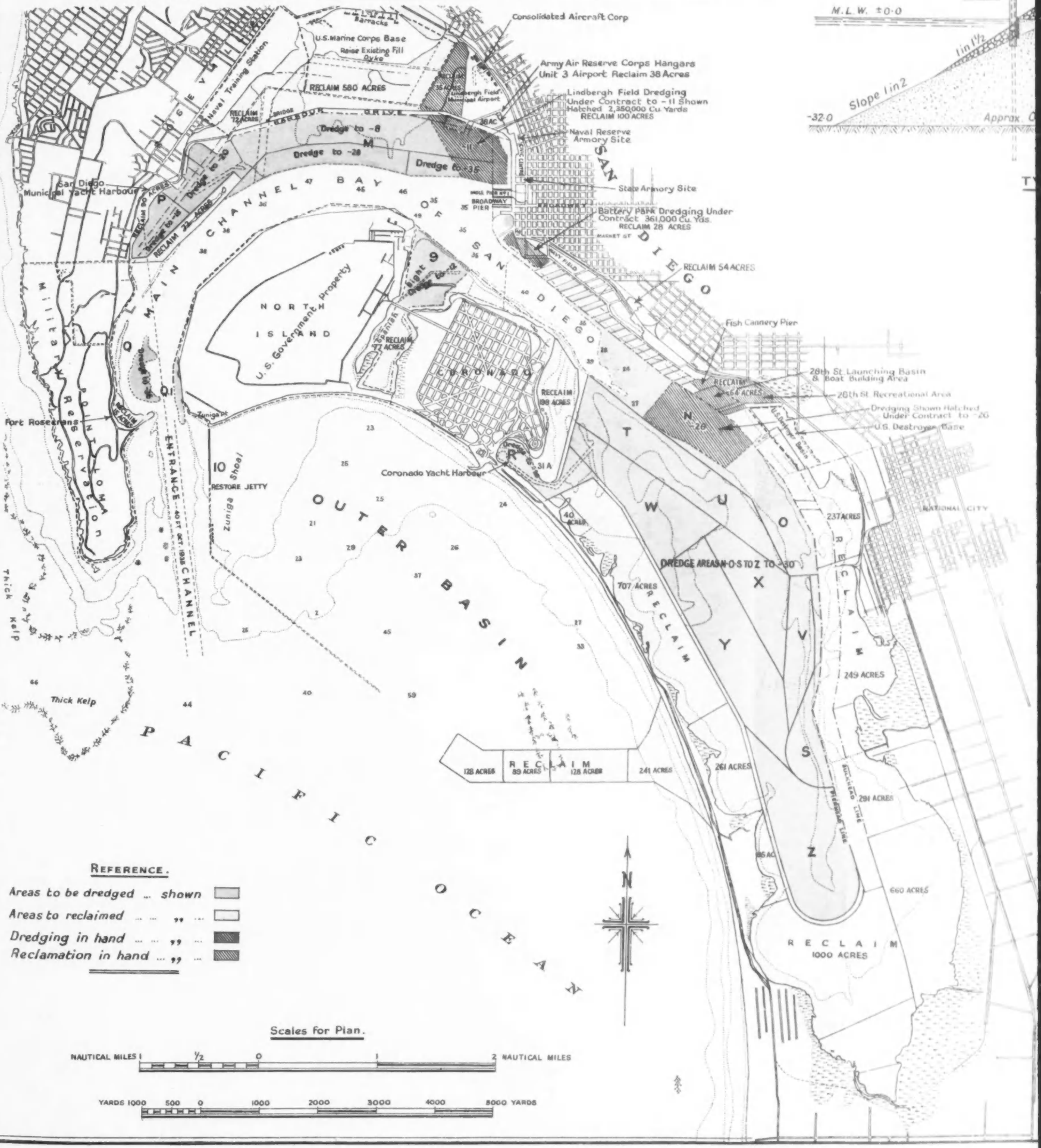
Another point worth consideration is that in the inevitable pressure for more rolling stock it is quicker as well as cheaper to build canal boats than to build railway trucks or lorries.

Yours faithfully,

D. ROSS-JOHNSON.

PORT OF SAN DIEGO.

ENGINEER TO THE SAN DIEGO HARBOUR COMMISSIONERS;- M.N.DONNAN, ESQ.



REFERENCE.

Areas to be dredged ... shown
Areas to reclaimed ... ... ,, ...
Dredging in hand ... ... ,, ...
Reclamation in hand ... ,, ...

Scales for Plan.

NAUTICAL MILES 1 ½ 0 1 2 NAUTICAL MILES

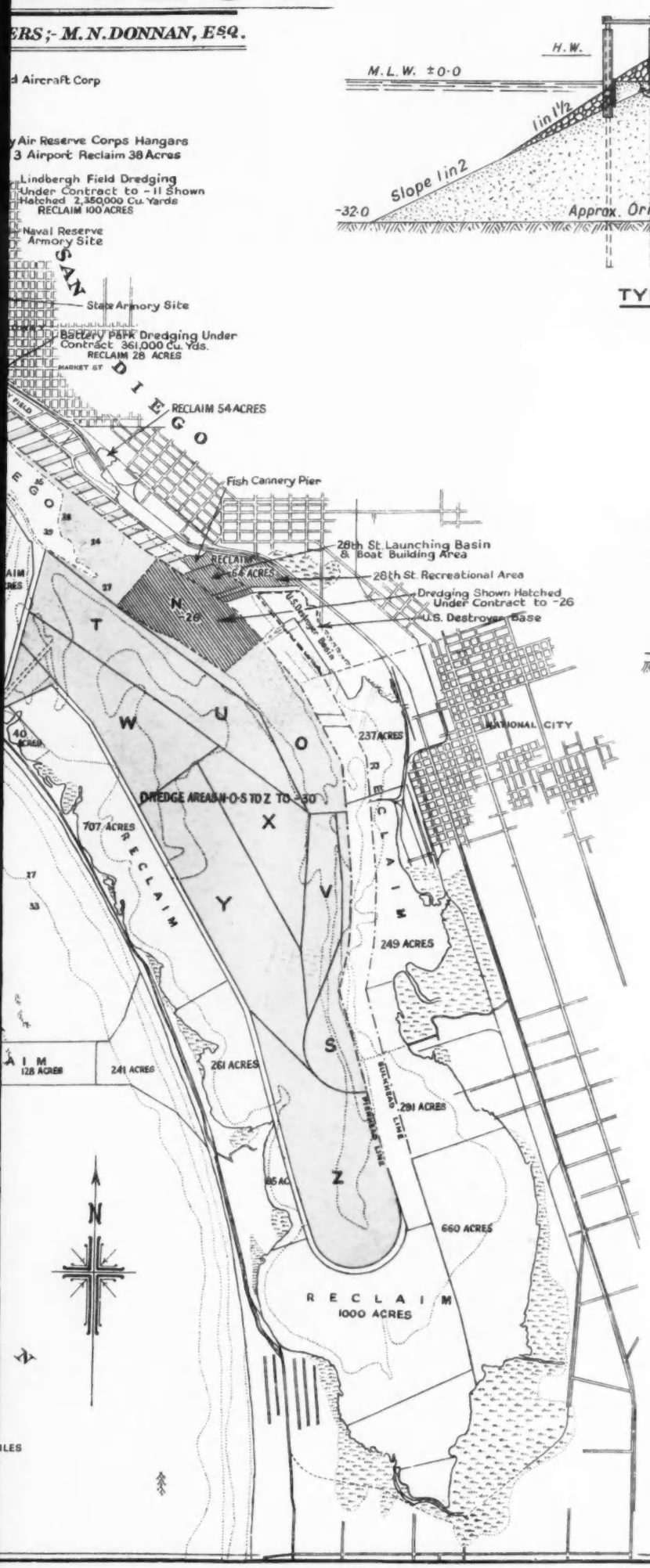
YARDS 1000 500 0 1000 2000 3000 4000 5000 YARDS

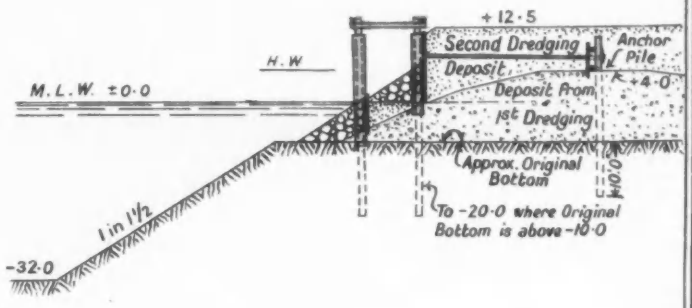
WARD & FOXLOW, LITH., HARCOURT STREET, MARYLEBONE W

TO THE DOCK AND HARBOUR AUTHORITY, DECEMBER, 1938.

DIEGO.

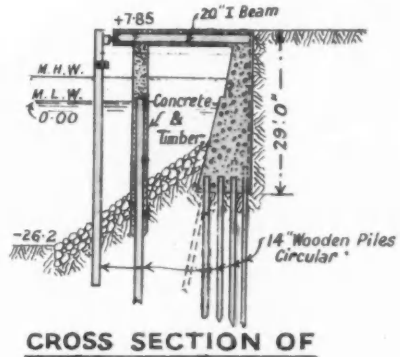
ERS;- M.N.DONNAN, ESQ.



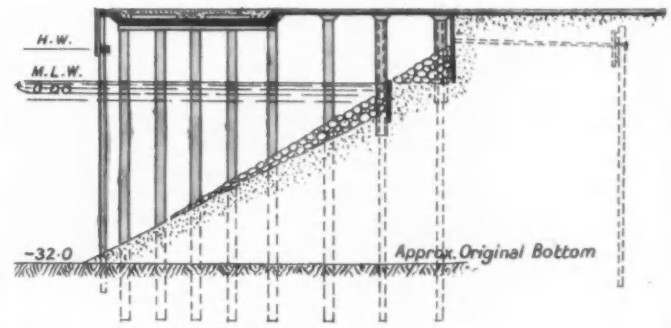


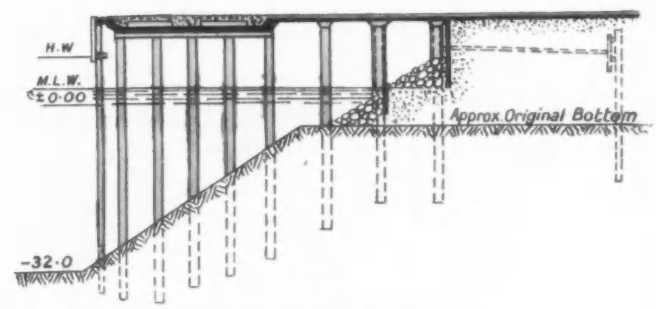
MOLE PIER Nº 1.

TYPICAL SECTIONS SHOWING DREDGING OPERATIONS.



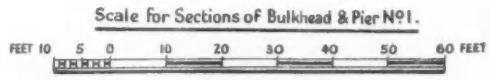
CROSS SECTION OF BULKHEAD.

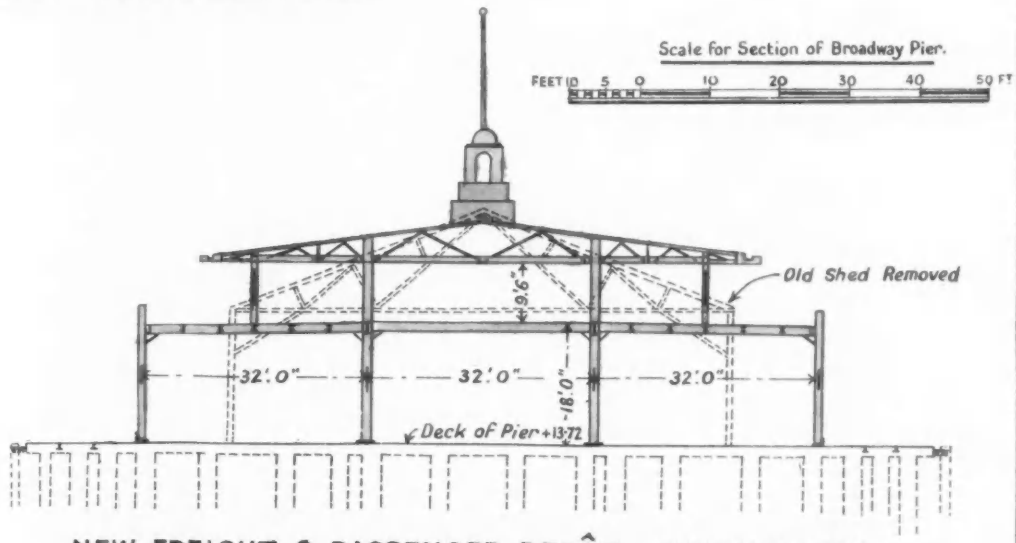




MOLE PIER Nº 1.

TYPICAL SECTIONS OF APRON WHARF.





NEW FREIGHT & PASSENGER DEPÔT — BROADWAY PIER.

WARD & FOXLOW, LITH., HARCOURT STREET, MARYLEBONE, W.

Notes of the Month

Cardiff Docks Centenary.

At the Mayoral Luncheon on November 10th, Alderman W. G. Howell, the Lord Mayor of Cardiff, referred to the Centenary next year of the Cardiff Docks, and expressed the hope that the Great Western Railway, the present owners of the docks, would mark the event in a suitable way. He is taking the matter up with some of the industries concerned to see whether an exhibition can be arranged.

Port Policy Committee for Holland.

It is announced that the Ministry of Economic Affairs of the Netherlands has appointed a new Advisory Committee for port policy. In Holland, the various ports all have their own special trade character, as for instance, Delfzijl, strawboards; Harlingen, agricultural products; Amsterdam, general cargo; Rotterdam, bulk cargo; and Dordrecht, local cargo and Rhine traffic. It is the intention to co-ordinate port policy, and the fact that the big ports are municipal ports will not be overlooked.

New Quay for Larvik Harbour, Norway.

A tender for the construction of a reinforced concrete quay, 100 metres (328-ft.) in length and 11.5 metres (37¾-ft.) wide has been accepted by the Larvik Harbour Board. The quay, which is to be completed by July, 1939, will be situated at Revet, at the mouth of the River Lagen. The work will cost 288,000Kr., and will involve the dredging of approximately 40,000 cu. metres of sand. A movable portal crane is also to be provided at a cost of 99,800 Kr.

Improved Dry Dock Facilities at Cardiff.

The extension of No. 2 dry dock, belonging to Mountstuart Dry Docks, Ltd., Cardiff, has now been completed. The work, which has extended over six months, was carried out in such a way that it did not interfere with the dry docking of vessels while the alterations were in progress. With this improved facility, the Mountstuart Company now have three dry docks at Cardiff, two at Newport and another at Barry, all capable of docking vessels of greater tonnage than those usually visiting the ports at present.

Proposed Glass Waterfront at Liverpool.

The recent development of the use of glass for bricks and building material has led to the construction of a permanent exhibition building of glass bricks as a feature of the design, issued by Mr. G. Grey Wornum, F.R.I.B.A., for a new Liverpool waterfront built principally of glass. The design shows two large buildings built right and left of the existing imposing buildings at the Pierhead, linked by a covered way. The scheme includes a new Riverside Station with a tower, to be built almost entirely of glass.

Harbour Extension at Lerwick.

The Lerwick Harbour Trustees recently had under consideration several schemes for harbour extensions and improvement works, varying in estimated cost from £28,000 to £34,000. Owing to conflicting views about the most suitable scheme for the trade of the port, it was agreed to submit the plans to the North of Scotland and Orkney and Shetland Steam Navigation Company, whose steamers largely use the main pier at Lerwick, and the Shetland Chambers of Commerce, for their views and observations upon the matter.

Extension to Stranraer Pier.

The London, Midland and Scottish Railway Company have commenced work on an extension to Stranraer Pier, to provide additional facilities for dealing with the motor-car traffic. To enable cars to be handled more expeditiously, part of the new extension will be adjustable, and will be raised or lowered according to the rise and fall of the tide, so that the vehicles will be run straight on or off the steamers. In conjunction with the scheme, a new vessel is being built which will enter the harbour stern first, so that the cars, which will be carried aft, can be loaded or unloaded at greater speed.

Improved Tyneside Facilities.

In consequence of the recent increases in passenger traffic and the timber trade, the Tyne Improvement Commission have decided to lengthen the passenger platform at the Tyne Commission Quay, North Shields, by 100-ft., at an estimated cost of £1,400, and to lease an area of 10 acres at Northumberland Dock to a firm of timber importers for a period of 10 years at an annual rental of £1,100. The land, in the latter case, has been levelled in places and railway sidings provided at a cost of about £7,000. Two additional locomotives are to be provided next year for the North side docks. Coble Dene repair yard is to be re-modelled at a cost of £18,000.

Dock Charges at Southampton.

The Southern Railway has applied to the Minister of Transport for an order increasing certain of the maximum rates, rents, tolls and charges leviable by the company at Southampton Docks.

Radio Beacon for Tyne.

The Tyne Improvement Commission recently decided to install, subject to the approval of London's Trinity House and the Board of Trade, a wireless beacon, with a range of between 50 and 60 miles, in the North Pier Lighthouse at Tynemouth. The beacon will be of great benefit to ships trading to the Tyne.

Improvements at Colombo Harbour.

Extensive improvements at Colombo Harbour have been approved. The plans include the construction, during the next two years, of an oil dock and deep-water quay, and the cost of the entire scheme is estimated at approximately £1,000,000. The ultimate benefit to the revenue is expected to exceed £100,000 per annum.

Manchester Ship Canal.

The approximate traffic receipts of the Manchester Ship Canal for the month of October amounted to £103,800, compared with £120,500 for October, 1937. The aggregate receipts for the ten months, January to October, 1938, were £1,066,589, a decrease of £44,132, compared with the corresponding period of last year.

New Lift Bridge for Bristol.

The Bristol County Borough Council has received a grant from the Ministry of Transport for the construction of a new lift bridge of the bascule type, over the floating harbour. The bridge will span the arm of the floating harbour known as Welsh Back, and will permit the passage of dock traffic to and from the northern part of the harbour. It is estimated the cost will be over £80,000.

Felixstowe Passenger Pier to be Demolished.

As it is considered to be unsafe, the London and North Eastern Railway are to demolish their pier at Felixstowe, which was formerly used by the river boats plying between Ipswich, Harwich and Felixstowe. The removal of the pier will not affect the running of the ferry-boat services between Felixstowe, Harwich and Shotley, as the vessels operating this service will continue to use the pontoon situated in Felixstowe Dock.

Support for Tyne Tunnel Scheme.

The proposal for a tunnel under the Tyne between North and South Shields received the support of the Sunderland Town Council and the Sunderland Chamber of Commerce at a recent meeting, at which a deputation from the two Tyneside towns stated their case, explaining they were only asking for sympathetic interest and not for any financial assistance.

Jarrow Howden Ferry to be Closed.

The Jarrow Town Council decided at a meeting held early last month, that the Jarrow Howden ferry is to be closed at the end of the year. It was stated that although the ferry served the whole community of Northumberland and Durham, and therefore should receive some consideration from other Authorities, in spite of repeated delegations and committee meetings, Jarrow was still left to bear the expense of running the ferry service.

Extension of Avonmouth Dock.

The Port of Bristol Authority are inviting tenders for the extension of the Eastern arm of the Royal Edward Dock, Avonmouth. The work will consist principally of the removal and conveying to spoil of approximately 500,000 cu. yds. of excavated materials and the construction in the dry of a reinforced concrete wharf, about 1,100-ft. long on each side of the extension, and also the driving of pile foundations for two buildings and the construction of two timber jetties. The number of reinforced piles to be made and driven in connection with this work is approximately 2,000.

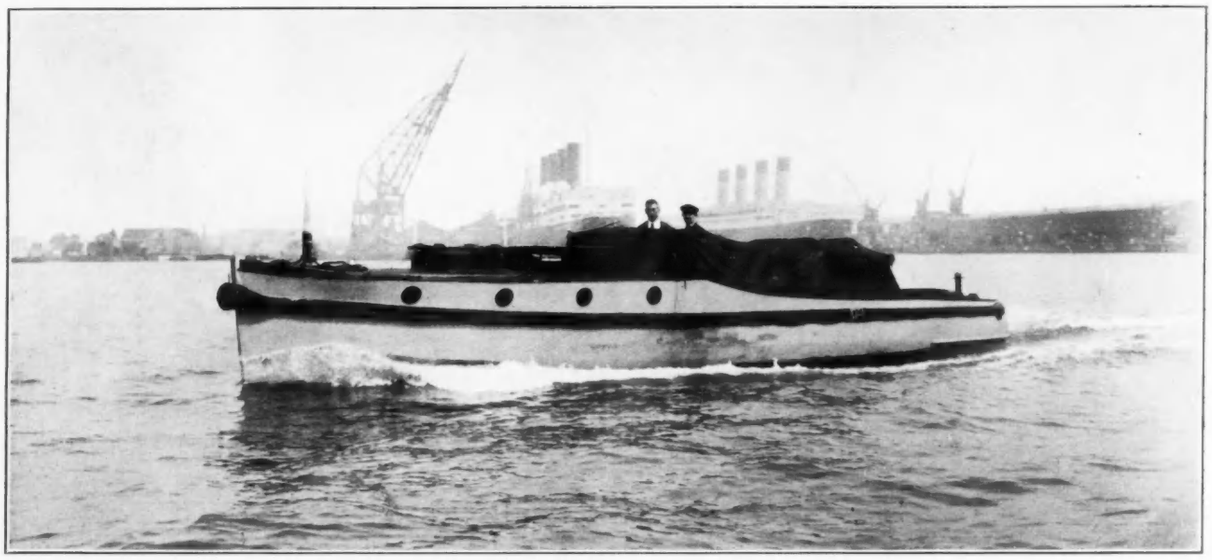
Floating Dock under Consideration for Stockholm.

With the growing trans-oceanic traffic at the Port of Stockholm, the docking facilities for larger ships have become unsatisfactory, and the Harbour Board has requested grants to build a floating dock on which it will be possible to dock ships of up to at least 10,000 tons. It is calculated the dock will cost 2,150,000 kr., to which amount the city is to be asked to contribute 1,900,000 kr. The remaining 250,000 kr. would be paid by the Finnboda Varv, the largest shipyard in the port, to whom the dock would be leased.

Health Administration in the Port of Southampton

The Functions of a Port Medical Officer

By H. C. MAURICE WILLIAMS, M.R.C.S., L.R.C.P., D.P.H.*



View of Launch of the Medical Officer of Health at Southampton

THE work entrusted to the Port Health Authorities throughout the principal ports in the country is of immense importance in safeguarding the health of the community. It is only by the early detection and isolation of infectious diseases brought to our shores in ships or by aircraft from foreign lands that severe outbreaks of major epidemic diseases do not more frequently occur in our midst. There are people who are unaware that such a service exists, and many, whose work is connected with the docks and shipping, are not fully cognisant with the extent of the work or the statutory powers conferred upon the Port Health Service for the proper execution of its duties.

The Port Health Service might well be called the " Silent Service," as it does not receive the publicity, nor does it advertise its work like many other branches of the Public Health Service.

The department in Southampton is a section of the general Public Health Service, maintained and controlled by the Southampton Borough Council, with the Medical Officer of Health for the town as the principal Port Medical Officer.

The majority of Port Health Authorities are constituted on lines similar to those in Southampton, but there are a few exceptions, such as Swansea and the Tyne, whose Port Health Authorities consist of representatives from multiple local authorities, whose jurisdiction extends over more than one docking area.

The Public Health Act, 1936, changed the designation of " Port Sanitary Authority " to " Port Health Authority," as it was considered to be a more dignified title.

Inspection and Detention of Ships

For many centuries the dangers of sea-borne infection have been fully realised. Indeed, the word " quarantine," first used by the Venetians, owes its origin to the forty days' detention of ships as a precaution against plague in the 14th century. With the passage of time, quarantine methods have been considerably modified, and it is a matter of interest to note that about two hundred years ago some ships were actually sunk to prevent the spread of infection therefrom.

The jurisdiction of the Southampton Port Health Authority includes the docks, and extends over an area of about 15 miles down Southampton Water, the Solent and Spithead. Boarding and inspection of vessels are carried out by members of the department, consisting of three medical officers, a chief port inspector and six assistant inspectors.

In 1937, out of a total of 2,681 vessels from foreign ports, 2,164 were boarded by either one of the medical officers or port health inspectors, and in addition, 962 vessels arriving from British coastal ports were boarded by members of the staff.

Vessels from foreign ports which berth within the docks or anchor within the area of jurisdiction to land passengers by tender are boarded, on arrival, by officers of the Port Health Authority and H.M. Customs. These officers are received by the Commander or the Ship's Surgeon, who delivers a signed Declaration of Health stating whether there has been any illness amongst the passengers and crew during the voyage. Occasionally, the vessel is boarded by an officer of H.M. Customs prior to the visit of the officer of the Port Health Authority, and in such a case a form is left with the Master by the Customs Officer indicating the condition reported on the Declaration of Health, and stating whether the vessel has been:—

(a) Granted full pratique;
(b) Granted modified pratique;
(c) Or detailed for inspection by the Port Medical Officer.

Vessels which trade exclusively within the " Home Trade " limits are not required to present a Declaration of Health, but the Southampton Port Health Authority request them to complete a Blue Medical Certificate, giving essential particulars regarding infectious disease (actual or suspected) on arrival.

There are five principal diseases which come within the category of what are termed " major infections," namely, plague, cholera, yellow fever, typhus fever and smallpox. The Ministry of Health, who receive information through the Office International d'Hygiene Publique, send each week to the Port Medical Officers a record of the ports which are infected, or believed to be infected, with these major infections. The H.M. Customs and Pilots are then notified of these places by the Port Medical Officer. Such ports are termed " infected ports," and special care is taken in the examination of the vessel on arrival.

During recent years, the use of wireless has greatly assisted Port Health Authorities in carrying out their work. In 1933, the Ministry of Health published in the London Gazette a notice that the provisions of Article 6 of the Port Sanitary Regulations, 1933, shall apply to the Southampton Port Health Authority. This article states that the master of any foreign-going ship fitted with a suitable wireless transmitting apparatus, on approaching such a district from a foreign port, shall, if any person on board has symptoms which may be indicative of infectious disease other than tuberculosis, or if there are any circumstances requiring the attention of the Medical Officer, send to the Port Health Authority a wireless message embodying such information as will indicate to them the conditions on board. These wireless messages are required to be sent so as to reach the Authority not more than 12 and not less than four hours from the time the ship is expected to arrive in the district. Any message in wireless code delivered to the Port Health Authority shall conform with the section relating to the 1931 International Code of Signals.

The majority of shipping companies send these wireless messages direct to the Authority's telegraphic address, and other of the shipping companies have agreed to transmit the messages through their local agents.

If a vessel on arrival is found to have, or have had, on board during the voyage one of the major infectious diseases, the Commander may be ordered to take and detain the vessel at a mooring station for medical examination. All passengers and members of the crew are then examined, and any case in which the diagnosis is in doubt may be detained for the purpose of investigation. Thus, actual and doubtful cases are removed to an

* Port Medical Officer and Medical Officer of Health to the County Borough and Port of Southampton.

Health Administration in the Port of Southampton—continued

isolation hospital, while the remainder of the passengers and crew are permitted to land after they have furnished the name and address of their final destination, which is forwarded by the Local Authority to the Medical Officer of Health of the district concerned. The duties of the Local Authority do not end here. They are required to see that adequate precautions are taken to prevent the spread of infection by bilge or tank water, by mosquitoes, by rats, by bedding and clothing, or by other articles likely to convey infection.

Map showing Area covered by Port of Southampton Sanitary Authority
Up to 30th September, 1935, shaded Dark Grey. From 1st October, 1935, shaded Light and Dark Grey

While the foregoing precautions are obviously necessary, it is with the more common infectious diseases that the Port Medical Officer chiefly has to deal. The Port Sanitary Regulations of 1933 authorise the boarding and inspection of any vessel arriving at the port and require the examination of any case or suspected case of infectious disease, together with the immediate contacts. Persons suffering from such conditions as enteric fever, diphtheria and scarlet fever, are removed to an isolation hospital, whilst those affected by measles, chickenpox, mumps, etc., may be permitted to proceed by private conveyance to their homes. The bedding and personal effects of the patients are removed to the disinfecting station, and the cabin or hospital in the ship is cleansed and sprayed with a 40 per cent. solution of formaldehyde gas in water.

Methods of dealing with Aircraft

The development of air travel has increased the work of the department during recent months. The Marine Aerodrome in Southampton Docks is now the base for the Imperial Airways flying boats. In July of this year regulations were issued, known as the Public Health Aircraft Regulations, 1938. The Port Medical Officer has thus powers to deal with aircraft in a somewhat similar manner to those applicable to vessels.

Particular attention has to be taken with regard to aircraft, for one has to bear in mind the risk of disease being introduced owing to the fact that passengers can reach England in a few days from countries where such diseases as cholera, smallpox and plague are epidemic, and the danger is that on landing such persons show no signs of illness as they are still within the incubation period of the disease.

Food Inspection

Much of the Port Medical Officer's time is spent in the sampling and examination of imported food arriving at the port. For many years special attention has been paid to the importation of mutton from New Zealand, Australia and South Africa, owing to the prevalence of a disease known as caseous lymphadenitis. Since stringent measures were introduced, there has been a very marked improvement in the condition of the carcases arriving. When the disease is discovered in any of the glands the whole of the carcase is condemned and destroyed. Vast quantities of food of every description are imported, and powers to deal with the inspection, detention and condemnation of foodstuffs by the Port Health Authority are given in the Public Health (Imported Food) Amendment Regulations, 1933. Some idea of the work carried out in Southampton during 1937 will be gathered from the fact that 582,110 tons of foodstuffs arrived, of which 891 tons were found to be unfit for human consumption.

Medical Inspection of Aliens

Each of the port medical officers also acts, under the Home Office, as an inspector under the Aliens Order, 1920.

Duties commence with the arrival of the cross-Channel boats, which are due alongside at 6 a.m. All British passengers are allowed to disembark and proceed to the Customs shed after their passports have been scrutinised by an officer of the investigation department. Alien passengers, however, are congregated in a large waiting room, and each takes his turn to come before the immigration officer, who ascertains the length of stay, the purpose of the visit and the amount of money possessed. All passengers pass before the medical officer in review, and he is required to pick out any suspicious case of infectious disease, or any which are likely to be in a verminous condition. In addition, aliens may be referred by the immigration officer, such as those intending to take up employment in this country, and who have already obtained a permit from the Ministry of Labour.

Under the Aliens Order of 1920, no alien is permitted to land in the United Kingdom if he or she comes under one of the following categories, that is, if found to be: (a) A lunatic, idiot, or mental defective; (b) Is suffering from veneral disease in a communicable state, pulmonary tuberculosis, leprosy, favus, ringworm, impetigo, scabies or trachoma (the last-named including doubtful cases); (c) Is found to be verminous. (In some cases permission to land may be given after cleansing and disinfestation). Of course, consideration is paid to the fact as to whether or not typhus is prevalent at the time in the country from which the alien arrives.

When any of these conditions are found, the alien is refused leave to land by the medical inspector, irrespective of the social or financial status of the individual.

In the case of infectious disease, an alien is allowed to land provided he proceeds to and remains in a hospital, approved of by the medical inspector, until free from infection. Conditions such as heart disease, chronic lung disease, defects and deformities which might subsequently prevent an alien from supporting himself and his family are carefully considered, and where there is a possibility of his becoming a charge to the State, permission to land is refused. Obviously, this does not apply to the tourist class of passengers, or those whose financial condition is good. These methods of dealing with aliens are carried out in a similar manner in all ships arriving in the port.

General Sanitation

Sanitary requirements of all ships are under the jurisdiction of the Board of Trade, but nuisances are dealt with by the Port Health Authority under the Public Health Act of 1936. The port health inspectors are, therefore, constantly engaged in inspecting and reporting any defects which constitute a nuisance and are a danger to the health of the crew or passengers. Samples of drinking water are sent at regular intervals to the public analyst, and all domestic water tanks receive cleansing from time to time.

The Rat Problem

The rat infestation of vessels has always been a serious problem, and rat suppression forms an important branch of the duties delegated to Port Health Authorities, for occasionally small epidemics of plague occur in the vicinity of our great ports, and it is for this reason that unremitting precautions are taken to prevent the introduction of this dread disease into the country.

In accordance with the Port Sanitary Regulations of 1933, the master of a ship coming from an " infected port " is required

Health Administration in the Port of Southampton—continued

to certify if he has knowledge of dead rats being discovered during the voyage, and is instructed to take such precautions as to effectively stop the access of rats from the ship to the shore. Instructions are issued to the master in the form of a Rat Order, which requires that the ship be berthed six feet from the quay, all mooring ropes and hawsers to be fitted with effective rat guards, or the moorings to be wrapped with canvas two feet in length, coated with tar, which is to be renewed daily; and that any gangway connecting the ship with the shore, and not in continuous use, shall have a man in attendance day and night. who shall be provided with a light from sunset to sunrise.

Apart from the danger of plague, apparently healthy rats, without themselves suffering from any obvious disease, are also the means of conveying such other diseases as spirochaetal jaundice (Weils Disease) and certain forms of food poisoning by the contamination of articles of food carried as cargo and ship's stores.

Rat bite fever, following the bite of a rat, is a rare but often fatal condition, and again, pig food, when contaminated with the excreta of rats suffering from such conditions as trichinosis, infect the pigs, and later causes an human infection. Not only as carriers of disease do rats form a menace to shipping, but they cause a serious loss commercially by the depredation and waste to cargo and structures.

One of the Food Inspectors at Work

The black rat (Rattus rattus) is the rat most commonly found on ships and in the dock area, whereas the brown rat (Rattus norvegicus) has its natural habitat in the town areas. It is an interesting fact that the brown rat is a comparative late comer to Europe, having entered Russia in large numbers by crossing the Volga in the early part of the 18th century.

Prior to this migration, the European area was occupied by the black rat, which is supposed to have travelled from its Eastern home before the 13th century, but in England and much of the Continent, apart from the seaport towns, the brown rat has been successful in exterminating its weaker ally.

The distinguishing features of the species are: The black rat is of lighter build, with a sharp pointed snout, and long, almost hairless, translucent ears, which reach, when drawn forward, over the eyes, the tail is slender and as long as the body and head together; whereas the brown rat has a blunt snout and small furry ears. The colour of the fur forms an unreliable guide as a distinguishing feature between the species.

The fact that from a pair of rats, whose period of gestation lasts but three weeks, and in each litter there are usually six to eight rats, it can be imagined that, given suitable surroundings on board a vessel, the resulting descendants would number many hundreds in a very short time, and for this reason it is essential that some means be adopted at periodical intervals to keep this prolific breeding in check. Previous to the introduction of the International Sanitary Convention, 1926, and instructions issued in the form of regulations designated The Public Health (Deratisation of Ships) Regulations, 1929, which came into force on January 1st, 1930, but which were later superseded by the Port Sanitary Regulations of 1933, it was obligatory for all ships trading with U.S.A. to be fumigated once every six months, but now, when the Port Health Authority finds that the ship is free from rats, or is maintained in such a condition that the rat population is kept down to a minimum, they may issue a Deratisation Exemption Certificate, which does away with periodical fumigation. If, however, it is found on inspecting the ship that there are more rats than one would expect, instructions are given to the shipping company to carry out a means of deratisation, either by intensive trapping or by fumigation.

(a) **Intensive trapping.** By the regular employment of rat-catchers who, when the ship is in port, set traps or lay poison baits. This necessitates an experienced man in the work, in order to decide on suitable bait, which varies on the cargo carried, and also to understand the common habits and the likely runs and breeding places on board ship in order that the cages or break-back traps be set in suitable places.

(b) **Fumigation.** The common methods of fumigation are: Sulphur, hydrogen cyanide (liquid), which is carried in steel cylinders, and hydrogen cyanide (zyklon B.), which is in the form of a powder.

The procedure adopted in each of the above methods of fumigation is as follows:—

Arrangements have first to be made between the shipping company and the fumigators, a date and time decided upon, and the Port Health Authority informed. Prior to fumigation, a thorough inspection of the vessel is carried out by the Port Health Authority, in order to supervise the sealing or opening up of various sections, and the prevention or removal of any harbourage which is likely to serve as a protection against the penetration of the gas where rats may hide. Such things as dunnage in holds, canvas, ropes, etc., in store rooms, stacks of bedding in cabins have to be distributed, bilge boards and casings are opened up to allow free circulation of gas.

In all methods of hydrocyanic fumigation, the exposure varies from two hours or longer. Gas masks used by the operators contain caustic soda, soda of lime, and charcoal; ammonia, lobeline and caffeine are carried in case of emergency.

During these operations no persons other than the fumigators or officers of the Port Health Authority are allowed on board, and a watchman is continuously on guard to prevent access by any unauthorised person. After the required hours of exposure, all hatches, ports, ventilators, etc., are opened up to free the vessel from gas, and every section of the vessel is visited and tested by the fumigators, who when satisfied, issue a certificate that the vessel is free from gas, and the crew and workmen can safely enter any part of the vessel. When testing for the presence of hydrogen cyanide, filter paper soaked in benzidene acetate and copper acetate (colourless) is used, which turns blue in the presence of 1 part in 10,000 of hydrogen cyanide.

Rat Proofing

When a vessel is to obtain a Deratisation Exemption Certificate, it is often necessary in order that the rat population shall be reduced to a harmless minimum to carry out extensive rat proofing, which will go far in minimising the possibility of plague, and will also save the tremendous damage and destruction done to cargo by the rodents. The principle aimed at in the rat-proofing ships is to make each compartment a separate unit which is inaccessible to rats. This is done by the closing of all unnecessary openings through which the rats can pass from one section to another, thus destroying the available runs by which they move about in search of food and water. Another important thing is to do away, as far as possible, with any harbourage which gives them an opportunity of hiding, and also serves as a breeding place. Rats may enter a rat-proof ship, but the difficulties of life and the risks of extermination will be too great for them to overcome, and they will naturally disappear. This work necessitates a detailed inspection of the whole ship by an officer of the Health Authority, who, after the inspection is completed, submits to the shipping company concerned a list of the necessary work which is required to be carried out.

Should the Port Medical Officer find on inspection that the rat proofing has been done in an efficient manner, and has resulted in reducing the number of rats on board to a harmless minimum, the shipping company may then, on application, be granted an Exemption Deratisation Certificate, which does away with the necessity of fumigation, and is accepted by all countries that have adopted the requirements of the International Sanitary Convention of Paris, 1926.

Not only is it important to make the living conditions of rats on vessels practically an impossibility, but this work has also to be extended to the warehouses, wharves, etc. All wooden floors in the sheds are being replaced by concrete, and all harbourages are removed which may serve as breeding places.

Although at first this rat proofing of vessels was met with a certain amount of scepticism, and opposition, the results obtained since its introduction fully justify the work, and it is now receiving the enthusiastic support of shipowners as an economic gain in eliminating the necessity of routine fumigation.

In this survey of Port Health administration, as encountered in one of our greatest "Gateways of Empire," one has endeavoured to show that not the least task of preventive medicine is the constant vigilance which must be maintained in the coming and going of ships, for the detection and prevention of infectious diseases, and in the control of the nation's food supply. The present organisation is a result of slow and gradual evolution throughout many centuries.

Our methods meet with no inconsiderable degree of success; yet, in view of the ever-increasing amount of sea and air-borne traffic, and of the vital importance of these services, I venture to hope that, in common with the development and extension of the Health Service generally, Port Medical work will receive the attention that it deserves, and continue to be a National Public Medical Service.

The National Harbours Board of Canada

Its Functions and Responsibilities*

Genesis of the Board

The National harbours Board Act was passed at the 1936 Session of the Federal Parliament, and came into effect on October 1st of that year. Its purpose was to bring about the abolition of harbour administration at National Ports by local Harbour Commissions and to substitute therefore a central National Harbour Authority.

The Act had its genesis in an exhaustive report made by Sir Alexander Gibb, a noted British Port Engineer, some years previously, wherein after making a detailed analysis of the weaknesses and defects of local harbour administration, Sir Alexander unequivocably recommended the change from local to National administration, stating in that connection that it was his reasoned opinion " that the efficiency and progress (of the National Ports) depend on the success or failure of the Federal Government in guiding their activities."

The Act provides for the creation of a National Harbours Board of three members. The Board is under the direction of, and responsible to, the Minister of Transport. Legally speaking, it is a Statutory Corporation created as an agency of the Crown and charged with the administration, management and control of the harbours and properties placed under its jurisdiction.

By the provisions of the Act the powers, rights and obligations of the former local Harbour Commissions are vested in the new Board, thus insuring continuity in respect of outstanding rights and obligations.

On the administrative side the Act gives the Board wide and general powers of management and control. Certain powers are reserved to the Governor in Council, who is empowered to make By-laws with respect thereto for the direction of the Board. Practically speaking, the chief power thus reserved to the Governor in Council is the making of rates and tolls on vessels and goods moving into or out of the harbours under the Board's jurisdiction. In practice, tariffs of rates and tolls are prepared by the Board after careful study, and submitted to the Minister of Transport. If the Minister approves, he in turn submits the tariff to the Governor in Council. When the approval of the Governor in Council has been given the tariff becomes effective on publication in the Canada Gazette.

On the financial side, the Board operates on an annual Budget which the Act requires the Board to submit each year to the Minister of Transport. The funds of each port are required to be kept separate from the funds of all other ports. In other words, there can be no intermingling or transfer of funds from one port to another.

As working capital for the Board, the Minister of Finance is empowered to make advances not exceeding $1,000,000 at any given time; such advances are repayable annually. The accounts of each port and the staff handling these accounts are under the direction and control of the Department of Finance, and all revenues received and expenditures made by the Board are subject to audit by the Auditor General of Canada.

On the Engineering side, only local and maintenance engineering is carried on by the local port staffs.

New capital works, when they have been approved by the Government and monies for the construction thereof have been voted by Parliament, are carried out as to the making of plans and supervision of work by the Board's staff of Engineers permanently located at Ottawa.

The Act provides that for works to be executed involving the expenditure of $10,000 or over, public tenders must be called; such tenders are opened publicly at a given time and place.

Local management of each of the harbours under the Board's jurisdiction devolves upon the Board's chief official at the port, the Port Manager. He is entrusted with the actual operation and maintenance of the port, and for that purpose is in direct charge of the local staff. In addition to his administrative duties, the Port Manager is charged with the responsibility of developing and maintaining close contact with port users, local authorities, and business organisations.

From the foregoing, it will be seen that the Act was drafted with a view to providing budgeted control of expenditures and improved direction of port administration and engineering practice.

The Board is required to obtain by Parliamentary vote monies necessary to meet deficits on account of operation and maintenance, interest due to the public on bonds outstanding, and for new capital expenditures. I may say that as and when outstanding bond issues in the hands of the public mature they are retired by monies voted by Parliament, and the monies thus voted become capital obligations of the Board to the Government.

The Board's Hereditament

May I now outline, briefly, the ports and properties which are administered by the Board.

On the Atlantic Ocean we have Halifax and Saint John.

At Halifax we operate seven large piers, with approximately 2½ miles of berthing, equipped with 13 transit sheds. We also operate a grain elevator with a capacity of 2¼ million bushels, and a cold storage terminal with modern freezing facilities and 1,000,000 cu. ft. of storage.

At Saint John, we have seven piers, with between 2 and 2½ miles of berthing, and 15 transit sheds. We also have a grain elevator at Saint John with a capacity of 1½ million bushels, and served by over two miles of grain galleries.

Both Halifax and Saint John are all year-around ports, but have their busiest season in the winter months when the St. Lawrence River is closed to navigation. In both these ports the Board controls and operates practically all the facilities.

On the St. Lawrence River, we have the harbours of Quebec, Three Rivers, and Montreal, and the Port of Chicoutimi, situate 75 miles up the Saguenay River, a tributary of the St. Lawrence.

At Quebec, we have four main piers with over 3½ miles of berthing and nine transit sheds. We also have a grain elevator with a capacity of 4,000,000 bushels; a cold storage warehouse with a capacity of half a million cu. ft.; and a fish freezing and storage house with a capacity of 1,000,000 pounds. In addition, we operate 32 miles of Terminal Railway.

At Three Rivers the Board operates three large wharves, with 1½ miles of berthing, and eight transit sheds. The harbour of Three Rivers is, of course, closely identified with the newsprint industry, and has a large tonnage of paper outward and bulk commodities inward, such as coal, sulphur, salt, and other commodities used in the manufacture of paper.

At Montreal, the Board operates all the port facilities, including 28 piers and wharves, with 27 transit sheds and over 10 miles of berthing; four grain elevators with a total capacity of 15,000,000 bushels, served by 3½ miles of grain galleries; a cold storage terminal, with a capacity of over 4½ million cu. ft.; and over 60 miles of Terminal Railway. We also operate the Jacques Cartier Bridge over the St. Lawrence River, which was completed some years ago, at a cost of $19,000,000.

Some indication of the magnitude of the traffic handled over our facilities at Montreal may be gleaned from the fact that in 1937 over 600,000,000 gallons of crude petroleum and gasoline were handled, and over 3¼ million tons of coal.

Here at Vancouver, as you all know, we operate two piers and two jetties, with 1¾ miles of berthing, and six transit sheds. We also administer, but do not ourselves operate, three grain elevators, with a capacity of upwards of 8½ million bushels. We also operate somewhat over 30 miles of Terminal Railway and maintain storage for almost half a million gallons of vegetable and fish oils. We also operate a fish dock and ice plant and other small facilities. Then, of course, the Board has under its direction the Second Narrows Bridge. Vancouver, incidentally, is the only port under our jurisdiction, where the great majority of the piers and wharves are privately operated.

So much for the above facts relevant to the harbours originally placed under the Board's jurisdiction by the National Harbours Board Act.

The Act further provides that the Governor in Council may at any time by Order-in-Council transfer any harbour or property of the Dominion of Canada to the Board for administration purposes. To date, three further properties have been transferred pursuant to this provision, viz., the Port of Churchill, on Hudson's Bay, where we have a large pier and transit shed, and a grain elevator with a capacity of 2½ million bushels; the grain elevator at Prescott, Ontario, with a capacity of 5½ million bushels; and lastly, the grain elevator at Port Colborne, at the Lake Erie entrance to the Welland Ship Canal, with a capacity of 3,000,000 bushels.

Summarising, the National Harbours Board at present administers assets representing a capital investment of approximately $225,000,000, comprising, in the aggregate, wharves and piers, providing 25 miles of berthing, capable of accommodating 212 ships at one time; 84 transit sheds, with floor space of 4¾ million sq .ft.; 13 grain elevators with a total capacity of 42½ million bushels; three cold storage terminals with a combined storage capacity of 6,000,000 cu. ft.; three terminal railway systems with a total mileage in excess of 120 miles; two bridges, and a multitude of smaller diversified facilities. In addition, the Board has large areas of land under lease as industrial sites.

The permanent employees of the Board number approximately 1,600, in addition to which the Board employs many hundreds of casual and seasonal employees, the numbers varying, of course, as business fluctuates.

In 1937, 80,000 vessels arrived at and departed from the ports under the Board's jurisdiction, and during that period 32,000,000 tons of cargo were handled.

* An Address delivered to the Vancouver Board of Trade, by R. O. Campney, Chairman, National Harbours Board, May 4th, 1938.

National Harbours Board of Canada—continued

From what I have already said, it will, I think, be readily realised that the task facing the temporary Board which was first formed, and the present permanent Board, which succeeded it, was indeed formidable.

The Board's Problems

A multitude of problems pressed for solution; there was the immediate necessity of establishing a working system of administration; of working out mechanics of operation which would insure the benefits of central supervision without at the same time unduly circumscribing or stultifying local administrative initiative at any port under the Board's control.

There was the need of increasing the efficiency of operation at the harbours and of reducing expenses, bearing in mind that the public using our harbours are entitled to the most efficient service possible at reasonable costs. This involved consideration of the question of excessive staff, the rearrangement of duties, and the elimination of unnecessary expenses. This in itself was a problem of considerable magnitude and not free from difficulty.

Then, too, there was the necessity of establishing immediate control of expenditures. There was the obvious need of putting into effect a proper uniform system of accounting at all ports. Another question requiring careful consideration was that of undue interport competition, and of discriminatory rates as between competing ports. There was also the need strongly pointed out by Sir Alexander Gibb in his report of strengthening of engineering services, and of giving closer study and more careful consideration to proposed new capital works before they should be embarked upon.

There were, in addition, what may be termed external problems of great importance. I refer to matters directly affecting users of the ports, such as the question of rates and charges, rentals, and By-laws governing the use of the ports.

In addition to all the general problems thus presented, each port had its own local problems to which, of course, at all times careful study and consideration must be given.

The task was not a light one, nor capable of easy solution.

The temporary Board, and the permanent Board subsequently appointed, went to work quietly, and for two years has been engaged in an effort to improve administration and work out solutions, one by one, of the many problems involved. While much still remains to be done, substantial and consistent progress has been made during the past two years.

A proper system of accounting has been set up in each port under the direction of the Comptroller of the Treasury. A Budget system has been introduced in each port, thus providing control over expenditures in respect of operation and maintenance. Considerable staff re-organisation and co-ordination has been effected.

Maintenance works have been closely supervised with a view to eliminating unnecessary and needless expenditures. Steps have been taken to insure collection of rentals and revenues generally in a more efficient manner. Numerous operating economies have been effected. Central control over new capital expenditures has been introduced, and engineering in connection therewith has been placed under direct control of the Board.

We have sought to improve and speed up our port services; to increase efficiency and despatch, and generally to do everything reasonably possible to insure that our ports shall more adequately perform their functions and enjoy good repute throughout the world.

Results Obtained

May I now briefly give you a few figures indicating the results which have thus far been obtained. Taking each of the harbours which has been administered under the new system during the past two years, and comparing 1937 with 1935 (the last year the harbours were under the management of local Commissions), we find as follows:—

In Halifax, an operating deficit of approximately $4,000, has been turned into an operating surplus of $152,000.

In Saint John, the operating surplus in 1935 stood at $50,000; in 1937, it was slightly under $200,000.

In Chicoutimi, an operating deficit of $7,000 was turned into a surplus of a like amount.

In Quebec, the operating deficit in 1935 stood at $315,000; last year it was $125,000.

In Three Rivers, the operating surplus of $45,000 increased to $150,000.

In Montreal, the operating surplus in 1935 was $1,600,000; last year it was $2,200,000—an increase of $600,000.

In Vancouver, the operating surplus in 1935 stood at approximately $800,000; last year it was roughly $925,000, showing an increase of $125,000.

The Second Narrows Bridge, which in 1935 had an operating surplus of $42,000, last year turned in an operating surplus of $102,000.

In the case of each of the above-named harbours, substantial reductions in expenditures contributed to the improved showing.

Speaking generally, the results obtained by the Board may be stated thus: In 1935, the last year the harbours were under the management of the local Commissions, aggregate operating revenues stood at approximately $7,400,000. In 1937, aggregate operating revenues were $8,200,000—an increase of over $800,000, or 11 per cent.

During the same period operating and maintenance expenses were reduced from slightly under $5,000,000 in 1935, to approximately $4,300,000 in 1937—a decrease of over $700,000, or 14 per cent.

In other words, in 1935 the aggregate operating income of the harbours of Halifax, Saint John, Chicoutimi, Quebec, Three Rivers, Montreal, and Vancouver, was $2,450,000, and in 1937 it was just under $4,000,000, being an improvement of over $1,500,000, or approximately 63 per cent. in the net position. All of which simply means that the taxpayers of Canada in 1937 had $1,500,000 less to pay in respect of the operation of the harbours which I have named, than they had to pay in 1935.

Notwithstanding the improvement which had been effected, there still remains, of course, a net deficit on the whole operation of many millions when one takes into consideration interest on capital and the necessary reserves against depreciation.

Much remains to be done, but the Board is diligently studying and tackling its problems one by one, and I believe substantial further improvement is possible.

Our work is fascinating and many-sided. To be engaged in the construction, operation and maintenance of facilities for the use of ships, and to be associated with those who go down to the sea in them and journey to and from far places, is a source of never-ending and constantly changing interest.

For ships are the blind instruments of trade, and trade is the chief material aim of every State. Where trade calls, ships will go, risks and dangers notwithstanding. And as they come and go, they bring a rich life to the ports they serve, for ports are the contact points where wares are interchanged and cultures touch.

Our Canadian National ports are among the great ones of the world. At them our great inland transportation systems meet the sea, and from them radiate trade routes to all the world. As a Board, we are seeking to build for those ports a reputation second to none.

Publications Received

The Report on **Economic and Commercial Conditions in Poland** by Mr. A. F. Merry, recently Acting Commercial Counsellor to H.M. Embassy at Warsaw, just issued by the Department of Overseas Trade (H.M. Stationery Office, Price 1s. 0d. net), contains a brief reference to shipping and the Port of Gdynia. " The development of the port continues, and special facilities are given to importers of goods through that port, as well as Dantzig, to encourage shipping. Moreover, exemption from taxation is granted in respect of tenement buildings erected in the port. An interesting publication in English, describing the Port of Gdynia, was published by the Ministry of Industry and Commerce early in 1937, and may be obtained from that Ministry through the good offices of the Polish-British Chamber of Commerce, Warsaw." A new scale of port charges has been in operation since December, 1936. Goods shipped through Gdynia in 1936-7 were mainly coal, coke, sugar, eggs, bacon and miscellaneous merchandise. All grain and flour exported by sea and over 85 per cent. of the timber was shipped through Dantzig.

A thesis entitled **Politica de la Marina Mercante Nacional,** by Dr. Remigio N. D. Stadler, reprinted in pamphlet form from the Review " Servir " of the Escuela de Estudios Argentinos, sets forth the imprimatur of the Argentine Naval League, the arguments for the formation and development of a mercantile marine for the country. It comprises 61 pages, and is published by the Liga Naval Argentina, Buenos Ayres.

Nationality of Carrying Vessels, issued by the Board of Trade and published by H.M. Stationery Office—price 1s. 6d. net. This publication reviews the Overseas trade of the United Kingdom for the year 1937, and gives in summarised form the value and proportion of imports, exports, and re-exports in trade with principal countries of consignment, carried in British vessels and in vessels of other nationalities.

A catalogue describing the improvements recently carried out in the Smith " Two-ten " Excavator, has been received from Messrs. Thomas Smith & Sons (Rodley), Ltd. The brochure which contains many illustrations, shows that the improvements effected have increased still further the capabilities of the machine, and gives details which should prove of interest to those engaged in the construction of docks and the maintenance of waterways.

The Port of Limerick

Recent Dock Extension*

By T. F. O'SULLIVAN, B.E., M.Inst.C.E.I.

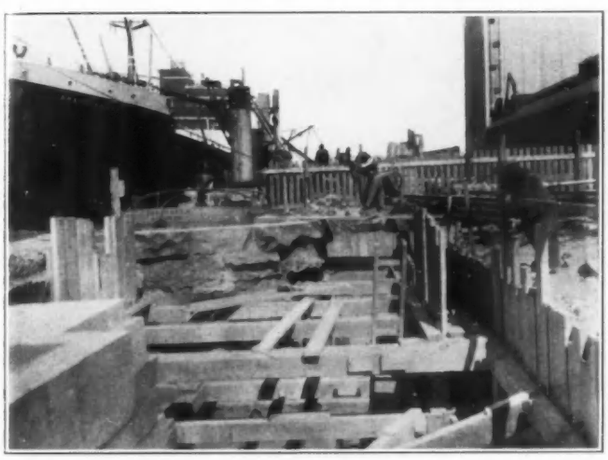
(Concluded from page 8)

Connecting Old and New Walls

When all the walls of the Extension and the Gate Chamber (to which reference is made later) had been completed, the work of connecting the new to old dock walls was begun.

As stated before, the old west wall of the dock and 50-ft. of roadway had been left standing up to now, so that the ordinary work of the port could be carried on for as long as possible, without interference, and also to act as a dam between the old and new basins.

South Side.—The old west wharf was now closed off, and the south wall of the extension carried in towards the old dock, the excavation being done in trench from the surface of the road down to rock foundation. The south-east corner of the old basin was dredged clean down to rock and a limpet coffer dam erected across the corner. This dam was made of 12-in. by 12-in. waling pieces, 12-in. by 12-in. uprights and 12-in. by 12-in. braces, with 9-in. by 3-in. sheathing spiked on, all joints being caulked, and the joints between dam and stonework being filled with canvas, and covered with timber strips scribed to the contour of the walls. Across the face of the dam at dock bottom level a concrete sill was constructed by diver, and over this was placed a blanket of clay. Kentledge was provided by concreting in the spaces between bottom walings and also by providing weights hung from the structure of the dam.



South Intersection—
Trench for connecting Old and New Walls behind Limpet Dam

Behind this dam the work of demolishing the old stone wall took place, and the new concrete south wall was connected with, and tied into, the south wall of the old basin.

North Side.—At the north intersection, a similar dam was constructed, but since there was not rock at this point, excavation at the corner of the old dock was taken down three feet down below dock bottom into the hard "red" clay. Two feet of concrete was laid underwater over the corner area and after the dam was placed in position an outer sill was built in concrete against the face of the dam, and a blanket of clay placed over the sill.

Leak at North Intersection.—The east end of the N.E. wall of the extension was carried out in trench, towards the intersection, as had been done on the south side, but when the trench had approached to within 6-ft. of the back of the old west wall a leak developed, from the old to the new basin.

The point of leakage was located as being outside the dam, and through the sheet piling, which lined the toe of the north wall of the dock. (See Fig. 3.) This sheet piling consisted of 14-in. by 14-in. pitch pine, spaced 4-in. apart, and for the first four feet of depth penetrated the "blue" alluvial clay, which under the action of the water had become reduced to a very silty condition. All work was suspended on the N.E. wall and trench, and attempts were made to stop the leak. Bags of clay were placed around the dam and along the face of the north wall of the dock, by diver, and a heavy blanket of clay was tipped over the bags. For a time the leak was got under control, but later it opened again. Eventually it was decided that the leak could not be stopped altogether from outside except with large works at a great cost, and it was decided to allow the leak to run slowly and fill up the new basin. As soon as the level in both basins equalised, the remainder of the N.E. trench was cleared out by diver down to foundation level, and the foundation was concreted in up to dock bottom.

All concreting underwater was done by a tremie, the concrete being placed by diver, and the cement content for underwater work being increased by 25 per cent., to counteract possible loss in placing. Since the water level of the old dock fluctuated in every tide, and, through the leak affected the level in the new basin, it was necessary to prevent this fluctuation affecting concreting operations. Accordingly, as soon as the foundation trench had been cleared out, by the diver, a 9-in. standpipe was placed vertically over the point of exit of the leak, carried above water level, and concreted into the foundation and the wall itself, as the work proceeded.

After the foundation had been concreted up to the level of the bottom of the basin, the diver set a course of precast concrete blocks 18-in. deep along the line of the face of the wall and a layer of concrete 18-in. deep was laid behind these blocks over the width of the wall by tremie. When this course had set, a new course of precast blocks was laid along the face of the wall and concrete placed behind them, over the width of the walls, 18-in. deep and level with the face blocks. In this way the remaining 6-ft. length of the N.E. wall was built up to a level of +10.00-ft. O.D., the leak being then well under control in the standpipe. The upper courses were later concreted in the dry, in the usual manner.

After the demolition of the old west wall, the facing up of the intersection of the new N.E. wall with the old N. wall of the dock, was carried out in precast blocks in a similar way, and the joining up of the two walls was carried out.

Pumping out New Basin.—After the leak had been controlled, the new basin was pumped out, a 12-in. steam pump being used for the purpose, and the work of finishing up all concreting in the extension and Gate Chamber was completed, and the bottom of the basin was levelled off.

Demolition of Old West Wall

On completion of all other work in the new basin the dragline excavator began to excavate the roadway and berm at the rear of the wall, leaving only the wall itself and a berm sufficient to act as a dam. Water was now admitted slowly to the new basin through a sluice in the limpet dam at the south-east corner. The filling up of the new basin was necessarily a slow operation, as water could be taken off the old dock only during high water, when the gates were open. When the filling was completed, the dragline working from water level removed as much of the remaining berm as possible to a depth of approximately—2.00-ft. O.D., and the demolition of the west wall began, the top courses of the wall being demolished to a level of +14.00-ft., 1-ft. above H.W.N.T. From this level holes were drilled to a level of—9.50-ft. or 1-ft. below the required depth. The holes were spaced 4-ft. apart along the centre line of the wall, the diameter being 2½-in. at the top, to 2-in. at the bottom of the hole. Each was charged with 6 to 10 lbs. of Polar N.S. Gelignite and denotated with Bickford Fuse, up to 4 holes being exploded at a time as conditions allowed. It was not found possible to charge up to the contemplated 10 lbs. maximum, due to the displacement of the courses of the wall masonry after blasting.

The drilling equipment consisted of 1 Ingersoll Rand Drifter Type Wet Drill, D.N. 75. The drill was mounted on a light steel frame suspended in guides by a flexible steel wire passing over a pulley at the top of the frame and returned to the barrel of a small hand winch mounted at the back of the frame. It was run on steam supplied from a boiler mounted on the north side of the wall and connected to the drill by a line of fixed piping terminating in a length of flexible steam hose.

The plant used for the removal of the debris of the wall consisted of one 3-ton steam Grab Dredger, 45-ft. rad., mounted on steel pontoons. Rock and half tine grabs were used on the rubble, and for cleaning up, a box grab. The material was loaded into 60-ton self-propelling barges, of which there were

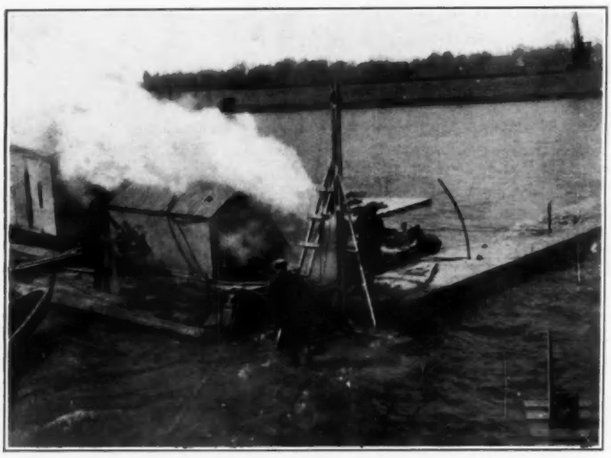
*A Paper read before the Institution of Civil Engineers of Ireland on 4th April, 1938.

Port of Limerick—continued

two at work, conveyed to the south wall and discharged by 5-ton steam crane into wagons, and hauled to the tipping ground.

As soon as a breach, of sufficient width and depth, had been made in the wall, the Commissioners' dredger—on charter to the Contractors—was admitted to the new basin. This dredger, of the self-propelling, bucket-ladder type, 150-ft. long by 32-ft. beam, capable of raising 300 tons per hour at 35-ft. depth, hopper capacity 400 tons, proceeded to dredge all the lighter "blue" clay in the berm at the back of the wall, and which, overlying the red boulder clay, formed about one-third of the berm. All spoil dredged in this way had to be conveyed to the dumping ground 20 miles down river. Attempts were made to dredge the red boulder clay in its undisturbed state with this dredger, but with little success, as the material was too tough and contained too many large boulders and too much stony material, the result being that repairs to the dredger were constant and costly.

Dredging of Red Boulder Clay.—The 3-ton Grab Dredger began the dredging of the red boulder clay but progress was slow as the capacity and weight of the grabs used were not nearly great enough. The spoil, as before, was loaded into barges and conveyed to the dockside, to be discharged by steam crane, and sent to the tip. Considerable difficulty was experienced in attempting to dredge out boulders, which were firmly embedded in the clay, and even the clay itself, when undisturbed, proved too hard for the grabs.



Demolition of Old West Wall
Drilling in Progress

Eventually blasting of the material had to be resorted to. A portable air compressor was placed aboard the grab dredger and the diver using an Ingersoll Rand Type B. BR. 13 jack-hammer, drilled holes up to 4-ft. depth, as required, into the hard material. Each hole, charged with Polar N.S. Geliganite, was detonated electrically. The grab dredger then lifted out the material so shaken up, and the final dredging of the new basin was completed in this manner.

Sweeping of Dock Bottom

Towards the completion of the underwater excavation, sweeping operations were begun to ensure that no obstructions had been left in the bottom of the basin. For this purpose a light barge was used, and amidships of this was located the sweeping frame. This consisted of a 3-in. by 3-in. by ½-in. M.S. angle 14-ft. long on the bottom, with two timber uprights each 4½-in. by 2-in. by 30-ft. long bolted on to the bottom angle. Both uprights were graduated in feet and inches and had ¼-in. diam. holes bored through every 2-in. apart. The uprights rested in guides bolted to the sides of the barge.

Two rope guys were taken from each side of the sweep bar, fore and aft. As the water level varied in each tide, the sweep was first adjusted to the required depth and prevented going deeper by pins, passed through the holes in each upright, and resting on the guides. The four guys were then made taut. Parallel sections, 10-ft. apart, were taken, for the full length of the basin, Section O^1 being along the line of old west wall. A span wire marked off every 10-ft. was stretched across the basin on line Section O^1 and the sweeping barge pulled slowly across on the wire. All obstructions met were booked and their location noted for later removal. This sweeping was carried out in a similar way on all other section lines until the full area of the basin had been covered. As the sweeping bar was 14-ft. long and the sections were 10-ft. apart, there was a constant overlap of 2-ft. on either side of each section, to ensure that no part of the bottom would be missed. After some practice, it became possible to determine the nature and extent of any obstructions encountered, as the timber uprights of the sweep provided sufficient flotation for the sweep bar to enable it to be manipulated easily from the deck of the barge by one man, and used to feel out whether the obstruction was a boulder embedded in the clay or a loose stone, or again a patch of undredged clay.

PART IV.

PROGRESS OF WORKS ON PART II (GATE CHAMBER)

During the construction of the extension it was decided by the Harbour Commissioners that it would be economical to proceed with the construction of Part 2 of the programme of construction, the Gate Chamber. In July, 1934, Messrs. T. J. Moran & Co., Ltd., Dublin, who were already carrying out the Dock Extension Contract, began the work at the contract price of £17,635 3s. 0d.

Description

As will be seen from Fig. 4, the Gate Chamber is 86.0-ft. long with a nett width between walls of 70-ft. 0-in., the depth on sill H.W.O.S.T. being 25-ft. 6-in., the rise of sill being 17-ft. 3-in. or .246 the span. Gate recesses are provided to allow the gates, when open, to be clear inside the line of the walls. A 4-ft. 6-in. by 4-ft. 6-in. levelling culvert is provided at either side each with stop and chamber to take penstocks. Dam stops are provided at each end to allow for future gate repairs.

It is intended that the new gates, when installed, shall be operated by hydraulic rams, and machinery pits have been provided at either side for this purpose.

General Excavation

Excavation was carried out in open cut by the ¾ yd. dragline excavator to a level of +4.00-ft. O.D., the sides of the cut being left at a self-supporting slope of 2 vertical to 1 horizontal. All spoil was loaded into wagons and hauled to the area to be filled in. From level +4.00-ft. O.D., excavation for side walls was carried down to rock in timbered trench. After the side walls had risen to the same level the earth between the walls was excavated out by dragline.

Excavation in Trenches

Trenches for side walls were timbered as described before for the dock extension walls, all the excavation being done by hand, loaded into 1 cu. yd. skips which were lifted out of the trenches by 5-ton steam loco cranes standing on the banks and loaded into wagons as before.

Rock Excavation

Rock was found in trenches, as described already, lying fissured in slabs with fine clay filling the fissures. All the loose rock over the entire area of the Rock Chamber, both side walls and invert, were excavated out and all rock surfaces well cleaned down with water under pressure before concreting began.

Concrete

The concrete for side walls and invert was 1 : 8 (nominal) as already described in the dock extension walls and was mixed and placed in a similar manner. At either end of the Chamber cut off trenches were sunk in the rock in the invert and concreted in. Concrete in the invert was brought up in layers of not more than 18-in. in depth, care being taken that construction joints did not occur immediately over each other.

Hollow Quoins

The hollow quoins were formed from stones selected from the top three courses of the old west wall, their dimensions generally being 4-ft. 6-in. by 4-ft. 0-in. by 1-ft. 9-in. They were all cut and dressed on the site, and set in position in P.C. mortar specially gauged, and were concreted in as the work progressed. On completion of the side walls each quoin was dressed in place to a template, and finished smooth, straight and even. Bearing faces were rubbed down and polished true to line, horizontally and vertically, to a limit of .025-in. in 3-ft.

Sill

The face of the sill consists of stones specially selected from the old west wall, the dimensions generally being 3-ft. 6-in. by 2-ft. 6-in. by 1-ft. 10-in. As with the quoins they were set in the concrete as the work progressed and later dressed in position to template. On completion, all bearing faces were rubbed down and polished to a limit of .025-in. in 3-ft. The concrete around the sill was 1 : 6 (nominal) quality.

Pipes to carry electric cables were built in the side walls, with a trough left in the floor of the Chamber for the same purpose. Hydraulic and water supply mains were also provided for, from one side of the entrance to the other, and were concreted in as the work progressed.

Port of Limerick

Dock Extension—South and West Walls completed

Dock Extension—Dredgers moored at South Wall

Port of Limerick—continued

Culverts and Penstocks

The culverts were formed one in each side wall 4-ft. 6-in. square, and at each side a penstock stop and shaft is formed. The seating and grooves for the penstock being of selected limestone dressed and set to template and concreted in position. After setting all the bearing faces of the stop and groove were rubbed down and polished to an even surface to the usual limits.

End Slope

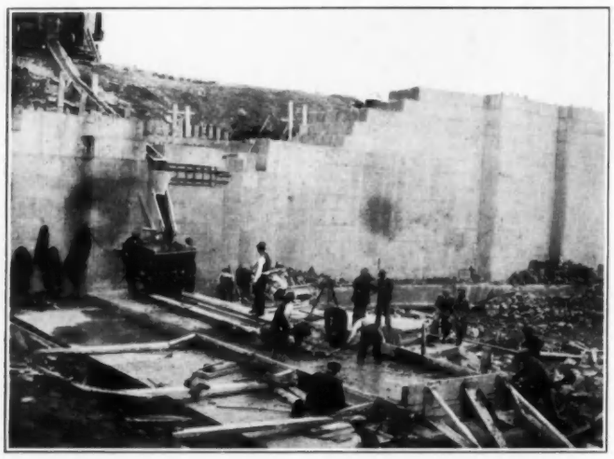
After concreting had been completed, some of the stone recovered from the demolition of the west wall was dumped on the slope at the end of the Chamber to form a revetment.

PART V.

GENERAL

Miscellaneous Works

The boundary wall, separating the site from the Dock Road, was raised to 9-ft. high in concrete placed *in situ*, and a 9-ft. timber post and pale fence topped with barbed wire was erected along the new western boundary of the Commissioners' property.



Gate Chamber Concreting of Sill

The river embankment, at that time the property of the Corporation, had been breached in 1928, by an exceptionally high tide during a S.W. gale, and serious loss and damage had been caused. To prevent any likelihood of a similar occurrence, care was taken that the first suitable heavy soil recovered from the excavation of the basin was tipped along the back of that part of the embankment on the Commissioners' property.

A system of open drains existed in the adjoining low ground, and before filling in this area a new 9-in. E.W. drain was laid to connect up with the city sewer.

Steps cast in the face of the wall are provided at the north intersection and at the S.E. corner of the docks.

Steel ladders, flush with the side of the wall, are built in at the south intersection and the N.W. corner and two are also provided in the Gate Chamber.

Cast steel horn bollards are fixed at the quay edge at intervals in the extension. They are anchored into the walls with two 1½-in. diam. M.S. anchor rods and four 1-in. diam. holding down bolts.

Four old mushroom type mooring posts which were reset, and six new C.I. semi-mushroom type mooring posts have been provided in the extension. They are set in 6-ft. by 6-ft. by 6-ft. blocks of concrete and filled solid with the same material.

The existing dock area was already lighted by 500 W. electric lamps carried on C.I. standards, and the system has now been extended to include the extension, six new E.S.B. Class II Steel Poles, each with standard 500 W. lamp and fittings, have been erected.

Owing to the nature of the materials forming the filled ground on the site of the extension, difficulty was found in forming the surfaces of the wharfs and roadways. Soleing was laid down in the worst parts and broken stone has been rolled in over the area to a depth of 12-in. After the ground has consolidated and final settlement taken place, concrete paved surfaces will be laid down.

At the N.W. Wharf Messrs. Cement Ltd., have constructed a reinforced concrete gantry on a piled foundation and erected a 5-ton Electric Portal Crane, and also built a new coal store alongside the wharf.

Quantities

The quantities of the principal items of the work carried out in the Extension and Gate Chamber Contracts are as follows:—

General Excavation, Earth	244,265 cu. yds.
Trench Excavation, Earth	7,370 „
Special Excavation, Earth	461 „
General Excavation, Rock	6,732 „
Trench Excavation, Rock	1,004 „
Trimming of Rock Foundations	1,640 sq. yds.
Concrete	25,734 cu. yds.
Stone Pitching 12" deep	417 sq. yds.
Steel Sheet Piling	183.45 tons.
Steel in Jetty Anchorages	40.75 „
Limestone in Sill, Quoins and Penstocks ...	1,729 cu. ft.

Costs

While the author is aware that the conditions governing each particular contract vary so much that, for purposes of comparison, costs are not of very great value, nevertheless some of the principal items given below may be of interest.

Total Cost of Construction of Works, Part I (Dock Extension), and Part II (Gate Chamber), £105,935.

Cost per acre of water surface (Extension only) ...	£24,600
Cost of South Wall, av. ht. 32.95 ft. ...	£26.75 per lin. ft.
„ „ North Wall, av. ht. 35.90 ft. ...	£28.26 „ „
„ „ North-East Wall, av. ht. 37.13 ft.	£30.05 „ „

Completion

All the works were completed in August, 1937, and the extension was opened to shipping immediately afterwards.

Accommodation

The Wet Dock, as extended, has a water area of 11.1 acres with wharfage accommodation of 3,220 feet, and provides berthage for 10 vessels. On completion of the scheme of development, vessels of 25-ft. draft can be docked on H.W.O.S.T.

Equipment

The Dock is equipped with:—

One 25-ton Electric Crane;
One 5-ton Portable Crane;
One 5-ton Portable Electric Crane (privately owned);
One Pneumatic Grain Discharge Plant, 100 tons per hour (privately owned);
Six Transit Sheds owned by the Harbour Commissioners are on the south side of the docks;
A Cold Store, also owned and operated by the Commissioners, is located on the south side of the docks.

Works Remaining to be Done

It is expected that circumstances will permit the Harbour Commissioners to proceed with the remainder of the scheme of development in the near future, *i.e.*, the New Entrance and Approach Channel and the closing up of the Old Entrance.

Already their enterprise has borne fruit, inasmuch as three industries have located in the extension area, and there is a likelihood that they will be followed by others.

Conclusion

The author ventures to reiterate the advice given some years ago in a paper before the Institution, also on harbour works, that accurate record drawings of all works as carried out should be made and preserved. No such records of the building of the original dock were available, and the lack of information on the subject proved a serious drawback in the preparation of the designs for the new work. It is partly for this reason that this paper has been offered, as the author found that a paper on the collapse of the dock walls (Hall, *Min. Proc. Inst. C.E.*, 1888) was of the utmost value, and was practically the only information that existed relating to the dock walls as constructed.

The author takes this opportunity of expressing his thanks to Mr. W. M. Fitzsimmons, B.A.I., who acted as Resident Engineer in the earlier stages of the work and to Mr. R. G. Murphy, B.E. (Associate Member), who later occupied the same position, for their co-operation and assistance during the carrying out of the Works.

The author also expresses his thanks to Mr. R. A. Japp, A.M. Inst., C.E. (Member), Agent and Engineer to the Contractors, Messrs. T. J. Moran & Co., Ltd., who carried out both Contracts to a successful conclusion.

Asknowledgment is also made to the Limerick Harbour Commissioners for permission to submit this paper to the Institution.

Southampton Docks Extension

Correspondence on Paper by Mr. M. G. M. McHAFFIE, M.Inst.C.E.*

Mr. John Anderson observed that the Port of Southampton was to be congratulated on the extension of its already considerable facilities, both mercantile and industrial, by the simultaneous acquisition of valuable new land and of docking and berthing amenities of the highest class.

The layout advocated by the late Sir Frederick Palmer had been supplemented by structural and constructional recommendations aimed at reduction of the estimated unit cost of the works (apart from the saving effected in length of quay), and a few points relative to the quay-wall design, in connection with those early considerations of the scheme, might be of interest. The problem of selecting a quay of suitable section for the tidal conditions and traffic requirements was exceptional, providing as it did for a height of 64-ft. above dredged level. Alternatives were, broadly speaking, limited to either solid monolith construction, or open quay of really stout construction.

In view of the adoption of the 45-ft. monolith wall, as originally designed and actually constructed for a short length, it was interesting to note the conviction expressed by Mr. Wentworth-Sheilds on page 362 that " big quay walls " of that type were " not really economical," and his reference to the handicap occasioned by the lack of a " rational theory of earth-pressures." Were the limitations of that type of wall to be attributed to the theory of its design rather than to inherent difficulties of construction? On investigating the required section for the Southampton quay-wall Mr. Anderson came to a similar conclusion, namely, that a wall of such height was penalised by the accepted theories. He found that the orthodox treatment, when applied to a monolith wall of great height, produced some unsatisfactory conclusions and more or less obvious anomalies as soon as the limiting toe-stresses and passive resistance became critical factors of the design. Owing to the rapid increase of depth and width of wall needed to satisfy those requirements, a point was reached where the unit cost of solid quay section became uneconomical, and an engineer might reasonably be influenced thereby to modify his theory, or to abandon the type of construction.

There was little doubt that the assumptions of orthodox analysis erred tremendously on the safe side, both in regard to the position of the centre of earth-pressure and its magnitude. From various analyses giving special consideration to those factors in the case of Southampton quay-wall, he found that a section from 15 to 20% lighter might have been considered adequate. The theory on which such analyses were made was based on the assumption of a virtual arch action developing in a vertical plane in the backing material as soon as passive resistance came into play. Although simple observations and experiments appeared to substantiate that theory (which might explain the continued safety of some walls on whose stability doubts might be cast by orthodox analysis) there was need for more definite knowledge and a sound basis of treatment. Mr. Wentworth-Sheilds had already presented an excellent approach on orthodox lines to the analysis of moderately large quay walls,[1] and it was encouraging to learn from him that Dr. Stradling was now at work on a theory of earth pressure which might justify an economy of design not hitherto considered safe by responsible engineers. Dr. Stradling had recently emphasised the value of practical investigation in the field of everyday engineering experience, as compared with laboratory experiments on soil-mechanics, and Mr. Anderson would suggest that problems affecting the design of quay walls particularly seemed to call for large-scale test observations.

Reverting to the Paper, there were some points upon which further light might be sought. The Author, in describing the modified quay wall, stated that it had been decided to compensate for the loss of stability incurred (through decreased sinking depth), by removing the gravel behind and forming it to a natural slope of 1 in 1½. It would be interesting to know what horizontal pressures had been allowed for, resulting in the retention of the original 45-ft. monoliths. It appeared on casual observation that they were, in effect, merely piers planted in the slope for the support of vertical loads and subject to very little unbalanced horizontal thrust. In that connection it would be useful to know whether the 2-in. tilt of the monoliths mentioned by the Author referred to the original section or to the revised section, and, if to the latter, whether the slope was grabbed out behind prior to the removal of the material in front. Were any observations taken to show whether the movement was due to tilt or to lateral displacement of the monoliths as a whole?

With regard to the work as carried out, it would be helpful to have any information as to the behaviour of the slope behind the monolitns under the scouring action of tidal ebb and flow and of ships' propellers. Had the pitching of the slope been placed by hand above low water? How far did the slab-beam over the piles extend into the top of the slope? It appeared to be rather shallow to prevent some spewing under it, unless the backing material had been specially selected.

It was good to learn from Mr. Szlumper's remarks on the modified quay wall that the cost of additional work of grabbing-out the slope and constructing the 4-ft. 6-in. slab, piling, etc., had shown a saving in cost compared with 23-ft. of monolith-sinking. It was also interesting to note that the natural slope of the ground was found to be so steep as 1 in 1½, because at the time of preliminary investigation it had been considered improbable that the ground would stand even at 1 in 2. That fact would certainly have favoured the construction of the type of quay-section recommended by the consulting engineers, at an estimated saving of £66 per foot run of wall, as compared with the solid 45-ft. monolith construction. That section consisted of 20-ft. square monolith piers, arranged in rows of four at 60-ft. centres, and driven to the depths which had since proved practicable in the actual work. Those piers were to support a massive deck of concrete and steel girders over natural ground slopes of 1 in 2, capped behind the quay by a blockwork wall above L.W.O.S.T. for retaining the reclamation material. The monoliths were to be connected together so as to form a triple portal frame which, with suitably-arranged steel would provide adequate support to such side-thrust as might have to be resisted from the material bearing upon the block-wall and rear monoliths. The principle of that method of frame construction was now being used on a smaller scale at the Victoria Dock of the Port of London, with advantages which would increase with the depth of berth. It would be seen that the monolith work involved in the piers was about 33% less than in the modified quay wall, the units being smaller and possibly more manageable. As an interesting possible alternative that scheme presented distinctive features which might appeal to engineers contemplating similar problems.

It was interesting to note Sir Henry Japp's suggestion that, at some future date, jetties might be built on to the existing straight quay, because it raised an aspect of the layout which might be overlooked. The five jetties which could have been constructed on the site available to provide equivalent accommodation would have precluded for navigational reasons the construction of the proposed future jetty (approximately 10,000-ft. of quay). Further extension then could only be provided by exploiting an entirely new area, such as the Marchwood foreshore. If provision had been required for a smaller class of ship, say from 500 to 600-ft. in length, it was probable that the advantages would have been in favour of the jetty layout for economic and navigational reasons, without sacrificing future developments.

Mr. E. J. Buckton observed that the Paper gave a most useful and concise description of the most important work of dock development in Great Britain in the post-war period. In 1926, Messrs. Rendel, Palmer & Tritton—of which firm the late Sir Frederick Palmer, Past-President Inst. C.E., had been senior partner—were asked to advise the Southern Railway on a proposed jetty scheme for extensions at Southampton Docks, and it might be helpful to give a brief statement of the views of the consulting engineers.

Only one scheme had been submitted by the company to the consulting engineers, which was the " five-jetty " scheme mentioned in the Paper, carried to a very full stage of development. After close and friendly collaboration with Mr. Wentworth-Sheilds, who was at that time Docks Engineer for the Railway Company, and with the Author of the Paper, who was then the Chief Assistant, the consulting engineers had advised the abandonment of the jetty scheme and recommended a straight quay wall scheme, giving their reasons for the recommendation and at the same time outlining and recommending a particular form of construction. In due course the company accepted the layout for a straight-line quay, but did not accept the consulting engineers' recommendations as to the method of designing and constructing the quay. The company decided instead to construct the quay of unusually large monoliths in a continuous row. The consulting engineers, who had been responsible for the continuous monolith quays for the Tilbury Docks extension which were proving quite satisfactory, had carefully considered the same method of construction for the quay at Southampton, but, as the quays at Tilbury were in an enclosed dock whereas at Southampton they were on an open tidal waterway, the depths in the latter case were much greater and the conditions became much less favourable for monolith work. After the most careful consideration as to constructional methods and cost, the consulting engineers had reported as follows:—

> " Our first proposal was the building of a quay wall on a continuous row of monoliths—a method of construction largely used where foundations are a difficulty—but it was found that the cost would be practically the same as for the

* Reproduced from the Journal of the Institution of Civil Engineers, by permission of the Council. The Paper appeared in the issue of this Journal for July, August and September, and the discussion in the issue of October and November.

1. "On the Stability of Deep-Water Quay Walls." Minutes of Proceedings Inst. C.E., vol. ccxiii (1921-22, Part 1), p. 135.

Southampton Docks Extension—continued

reinforced concrete method. Eventually it was decided to recommend the design now proposed, which consists of a series of monoliths sunk at right angles to the quay face, forming piers, between which the quay, and the inner half of the shed behind the quay, is carried on steel girders embedded in concrete.

" The cost will be less than for a continuous quay wall on monoliths, and, as will be seen, less than the estimated cost of the reinforced concrete quay proposals."

The elevation and cross section of the quay as recommended by the consulting engineers were given in Figs. 23 and 24 (below). It was true that the proposed construction as there

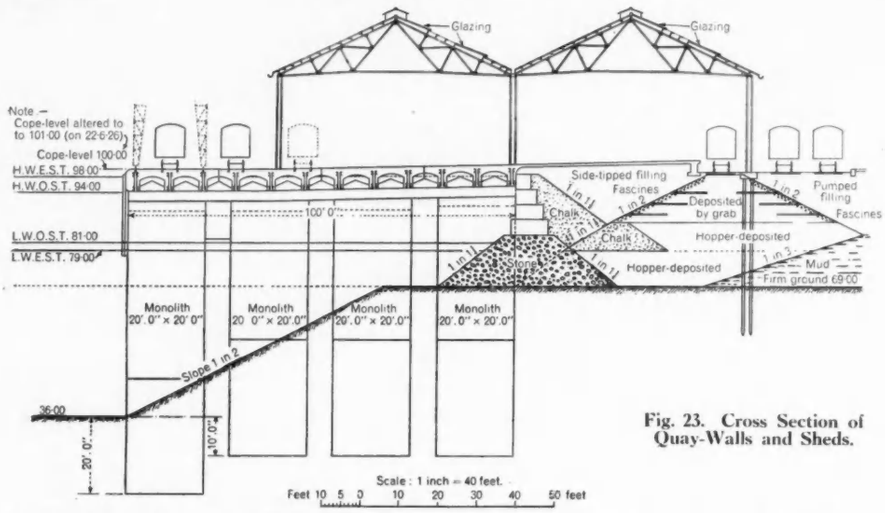


Fig. 23. Cross Section of Quay-Walls and Sheds.

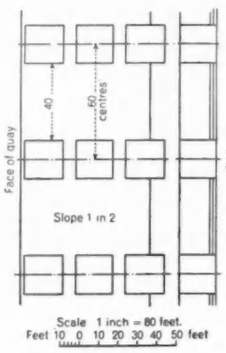


Fig. 24.

Horizontal Section showing Arrangement of Monoliths.

illustrated included monoliths, but they were separate monoliths of modest dimensions, acting primarily as piers. At Tilbury the quay was formed by a continuous row of monoliths of large dimensions, designed to retain the filling behind, with its surcharge, the principal duty of the monoliths being to resist a horizontal thrust. In the design for Southampton as recommended by the consulting engineers the principal duty of the monoliths was to carry a vertical load. The monoliths were in no way continuous; they were arranged in rows of four at 60-ft. centres, so that the whole structure became an open-deck quay, with a revetted slope of 1 in 2. During the discussions fear was expressed by the local engineers that the ground at the site was of such a nature that it could only be held by a continuous wall or a very flat revetment, and it was possibly that view which led to the ultimate adoption of a continuous wall of large monoliths capable of withstanding the thrust of the quay, with its surcharge. That view was in no way shared by the consulting engineers. Difficulty was experienced in trying to sink a continuous row of large monoliths in the conditions existing at Southampton, and the design was modified to lessen the horizontal thrust on the monoliths by adopting a decked quay with a revetted slope of 1 in 1½.

Costs were not given in the Paper, but the cost of trying to sink the monoliths to a designed depth and, later, in abandoning that principle and adopting a scheme dependent upon the retention of a slope behind the monoliths, decked over in reinforced concrete, was bound to have been unfavourable; a better and cheaper structure would, in Mr. Buckton's opinion, have been obtained if an open-decked quay had been adopted in the first place.

The relative merits and demerits of a straight-line quay, as compared with a series of jetties, were fully discussed during the investigations and were clearly stated in the consulting engineers' report. It was claimed that 7,500-ft. of straight quay were equivalent to 10,000-ft. of jetty quay. The estimated cost of the shorter straight-line quay was more than £1,000,000 less than the jetty scheme, and whereas the jetty scheme utilised the site to its full capacity the straight-line scheme as recommended and adopted had the valuable asset of permitting a further 150% extension as, and when, required—an important factor, since suitable areas for port development at Southampton were very limited.

There were many other matters of interest in the Paper, but Mr. Buckton had confined his comments to that phase which especially concerned the late Sir Frederick Palmer and the consulting engineers, as it appeared desirable that certain ambiguities, perhaps inevitable in so concise a Paper, should be cleared up.

Mr. K. O. Ghaleb, of Cairo, observed that the method of construction of the dock described on pages 290-293 was practically the same as that adopted to permit examination and repair of the square well enclosing the famous column of the Roda Island Nilometer. That monument for the gauge-recording of the river levels had been built in the year 247 of the Mohammedan Era (A.D. 861); it was therefore the oldest Arab monument in Egypt, and was unique in its conception. The well was supposed to be cleaned each year of the silt that accumulated during the previous flood; that cleaning had never been properly done. The deposit was generally only cleared as shown by the dotted curve " a " (Fig. 25); during the French expedition, at the beginning of the nineteenth century, General Menous' engineers succeeded in clearing the well down to the dotted curve " b " (Fig. 25); further attempts made in 1887 and 1927 were less successful. From the information left by the French expedition, there was no evidence that any part of the structure extended below the level of the 1.20 metre high marble base, and it was concluded that the bottom of the well chamber was paved with flagstones at that level. The column was badly handled during the nineteenth century, and during the latter half it started to sink gradually. It was difficult to know what to do; the bottom of the well had probably remained unseen from the time of its construction, and no ancient manuscript giving a reliable account was available (although the notes left by the French expedition were very useful). The last attempt, at the beginning of 1927, to unwater the cistern by pulsometers had to be abandoned for fear of the collapse of the whole structure; the column had to be propped up in a most unsightly fashion.

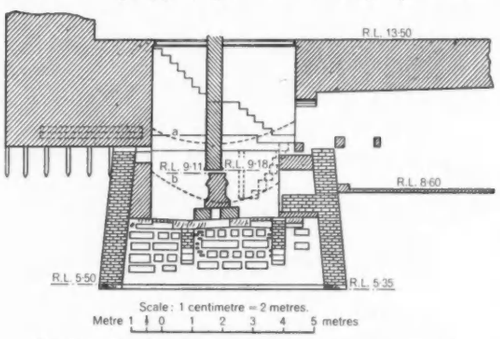


Fig. 25. Sectional Elevation (from West to East) of Lower Half of Well as found in 1937.

After a long and careful study of the question, it was agreed that the modern method of drying the ground was the most promising. It was stated in the conditions of tender that payment to the contractor for unwatering would only be made from the date of his lowering the water to such a level that work in the bottom of the well could be possible.

The eastern side of the southern extremity of the island (Fig. 26), on which is built the Nilometer, was enclosed during 1937 by steel sheet-piling between R.L. 17 and R.L.—3 metres on the land side, and R.L. 17 and R.L.—5 in the Nile. The water level of the Nile during the period of the operation of the pumps was R.L. 15.8; the average level during flood was R.L. 20.0. Trial borings to indicate the line along which the sheet-piles were to be driven diclosed that this extremity of the island, to a depth of about 10 metres, formed a huge mass of large and roughly-built calcareous stones with sandy clay underneath. Most of the stones utilised had been removed from the ancient monuments of Heliopolis. For lowering the water pressure, fourteen holes were bored, two on each side of the Nilometer well and six on the eastern side (Fig. 26). At each hole a tube 0.40 metre in diameter was sunk to R.L. —6, penetrating 22 metres into the

Southampton Docks Extension—continued

water-bearing stratum, and into it was placed a 0.2 metre diameter pipe, the lower end of which for a length of 11 metres was perforated and wrapped with a fine copper mesh to form a filter. The annular space around the inner pipe was filled with clean fine gravel in the vicinity of the filter, and with puddled clay above it, the placing of the fine gravel and puddled clay being done currently with the jacking-out of the larger tube. Each tube was equipped with an electrically-operated submersible pump 0.125 metre in diameter, discharging through mains into the Nile. The total quantity of water pumped amounted to $3\frac{3}{4}$ million cubic metres; the water was pure and clear. Pumping was begun at the end of February; by the end of March the mean water-level in the four observation pipes around the well (Fig. 26) has been lowered from R.L. 15.8 to R.L. 7.5, and it was kept between R.L. 7.5 and R.L. 5.5 until the end of June, when pumping was stopped.

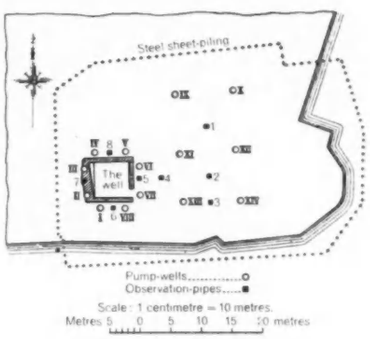


Fig. 26. Site-Plan.

The unwatering proved the existence of an unknown brick well (Fig. 25) lined inside with calcareous stones similar to those used for the main structure: they were found detached from the brick well. The latter was round (whereas the main well resting on it was square), slightly tapered, and was built on a wooden curb; inside it, but at a higher level, was a smaller one not concentric with it, also built on a wooden curb and filled with calcareous stones. That smaller well carried the wooden platform on which was placed an old granite millstone, which in its turn supported a marble base 1.2 metre high which carried the column of the Nilometer. The lower part of the well was nothing but confusion: the column, base, and platform were found to be separated from each other and engulfed in 4 metres of silt. The monument might have collapsed at any moment. The Royal Botanic Gardens, Kew, kindly analysed nine specimens of wood found in good condition inside the well, though it had been there since A.D. 861. With the exception of the circular platform that supported the millstone, the wood found was in a spongy state, but after drying it shrank and became very hard; the cypress beams of the timber flooring of the well, found at R.L. 7.63, still kept their pleasant aroma. The iron rails, some of them over 30 centimetres in length, that kept the woodwork together showed no trace of rust, whilst the lead and bronze props used for fixing the column had not deteriorated after having been buried for over 1,000 years.

The Nilometer, being an historic monument of primary, importance, had to be maintained in its original condition; to save the well from collapsing it was decided to fix a " chemise " around it, and to place a solid floor underneath it by underpinning (Fig. 27). As the well was to remain dry in the future, the bottom of it would have to bear an upward pressure nearly equal to that of the first Aswan dam; the heavy floor shown in Fig. 27 was therefore necessary.

The contract cost would amount to about £E35,000; the main items were:—

(i) Steel sheet piling, 160 metres in length, weighing about 450 tons, at about £E7,000.
(ii) Unwatering, first 90 days at £E225 per 24 hours and afterwards reduced to £E24 per 24 hours, amounting to about £E20,000.
(iii) " Chemise " and flooring, 1,600 cubic metres of ordinary concrete and reinforced concrete, amounting to about £E6,000.

Mr. H. J. B. Harding observed that in the discussion on the Paper, Mr. W. T. Halcrow had asked several questions about ground-water lowering which showed that he was under a slight misapprehension as to what had actually been carried out. Perhaps Mr. Harding, as a member of the graving dock contractors' staff, might be permitted to enlarge on the details which the Author had given.

The ground-water lowering method employed was not the well-point method, but was a deep bored-well system of ten wells, using submersible pumps, which were all electrically driven from a central switchboard. The term " well-point method " was usually adopted where a number of small-diameter tubes were jetted or driven into the ground to a depth of about 25-ft. at very close intervals, and water sucked from them. That method could not be used to reach artesian water at over 100-ft. below ground level, which could only be reached by means of bored wells penetrating deeply into the artesian strata.

Mr. Halcrow had doubted whether the fine copper-mesh filter would have worked satisfactorily if the sand had been very fine. In actual fact, the sand at Southampton was particularly fine, interspersed with layers of clay. The filter-wells also tapped each layer of sand as they passed through it, as stated in the Paper.

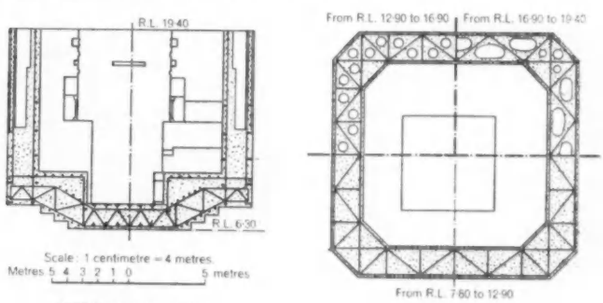
The wells at Southampton were about 200-ft. deep, the diameter at the bottom being 24-in. The filter-tubes in the wells in which the submersible pumps worked were 14-in. in diameter to give room for the pump, but there was an extra refinement at Southampton in the case of the permanent wells. It was known that eight of the ten wells were to be permanent, and that the strata from which they were to extract the water was lower than the actual working level of the pumps, as the water rose to the pumps under the artesian pressure. Advantage was taken of that to make the lower portion of the filter-tubes in the permanent wells only 6-in. in diameter, which gave more room than was normally the case for forming a gravel filter inside the 24-in. boring tubes.

Two different grades of filter-gravel were used, the finer material being outside, and the two filter-materials were kept separate during placing by a tube about 14-in. in diameter, which was withdrawn simultaneously with the boring tube, and ensured that the different grades of gravel were deposited correctly. The actual permanent filter-tubes were made of tinned copper, 6-in. in diameter, $\frac{1}{4}$-in. thick, with $\frac{3}{32}$-in. slots (fine enough to hold back the coarser filter material), and not covered with fine mesh, as was the case with temporary wells, as it was possible to get a 9-in. thickness of filter-gravel, making very fine mesh unnecessary. In a properly-constructed water-lowering system, the gravel filter should be relied upon to keep back the sand, and the mesh on the filter tubes was an extra precaution. The filter-gravel prevented the fine sand clogging the mesh on the tubes, as very little reached the tubes.

There should be no difficulty in obtaining a proper filtration without clogging, however fine the sand, as, if water could flow in the sand itself, it would flow into the wells, and if the gravel were graded correctly, that should be possible without sand being carried with the water. The fineness of the sand at Southampton was shown by the fact that the overflow in the permanent system was only about 250 gallons per minute from all eight wells, although the overflow level was 50-ft. below the artesian water level.

From the above description, it would be seen that there was every reason to expect a long life from the filters. It was possible to clean them out or back-flush them if required, and there was still room inside the well for a smaller filter-tube if that should ever be necessary.

The difficulties that Mr. Halcrow said he had experienced in forming a filter in the bottom of a cylinder might have been due to a wrong grading of the filtering material, and to the fact that the water had to enter under the bottom of the cylinder, and not through the sides, as with a filter-well.



Figs. 27. Reinforced Concrete Around and Below the Well.

The hydraulic principles governing the flow of water into artesian wells in porous formations showed that the quantity of water entering depended chiefly on the thickness of the porous strata and on the " draw-down " in the well. The " draw-down " was the cause of the curve of depression assumed by the water-table, and brought about the difference in head which caused the water to flow into the well at different rates, according to the permeability of the ground. The water entered the well throughout the area in contact with the porous strata, even if, as at Southampton, several different beds were met with, separated by layers of clay.

In the case of a filter at the bottom of a cylinder, it was impossible to obtain a deeper draw-down than the bottom of the cylinder, and all the water had to flow into a single thin horizontal bed. The depth of the cylinder in relation to the formation-level would be important. In a bored filter-well, the water was tapped for the whole depth of the bed by the vertical filter, into which it could freely flow, and in which a very considerable draw-down could be created by the submersible pump. Further, it was not always understood that one of the

Southampton Docks Extension—continued

chief features of a water-lowering scheme was the great effect produced in lowering the water-table by the use of a number of wells, as they " interfered " with each other, and their cones of depression intersected before reaching their individual levels. That could be better understood by referring to Figs. 14 and 15 (page 292) of the Paper. The effect of one well on the water-table would be very slight beyond a very short distance, but ten wells working together and spaced round the site lowered the water-table to a remarkable extent, with very little more total quantity of water pumped.

The 2-in. sounding wells described by the Author were essential for the proper control of the system while working. They were sunk first as a guide to the strata, before sinking the expensive 24-in. diameter wells. At Grimsby fish dock the sounding wells revealed a thinning-out of the porous strata and saved the sinking of wells in an unproductive area.

The Author, in further reply to the Discussion, and in reply to the Correspondence, wished first to correct a mistake in his reply to the Discussion; on page 29, line 27, the cost of the graving dock should have read " about £1¾ million."

The nature of the damage to the monoliths had been principally opening of the horizontal joints, in some cases to the extent of several inches, which indicated fracture of the vertical steel reinforcing bars at those places. The damage had not occurred in any particular zone, but had been confined to the blockwork above the reinforced concrete shoes. No damage had been observed in the shoes themselves, which appeared to prove that they were sufficiently strong and stiff. The worst damage had occurred in the external transverse walls, namely, those adjacent to other monoliths.

The rate of sinking had varied considerably, according to whether it was being done in the gravel embankment or in the virgin strata beneath, but taking a representative period when the work was in full swing, and disregarding the gradual working up to speed in the early stages and the gradual falling off in the later stages, the average rate had been about 60-ft. per week.

No very definite figure could be given for the sinking effort, as several of the factors which had to be taken into account in assessing it were variable. For instance, the flotation-value varied with the rise and fall of the tide and the amount of pumping it was considered advisable to do in the wells; again, the bearing value of the ground against the side of a tilted monolith and that of the ledge of firm greensand upon which the cutting edges rested during sinking, were not easily determinable. Having regard to all the circumstances and assuming certain values, it had been calculated that the sinking effort in the later stages of sinking was between 8 and 10 cwt. per foot super of external walls.

Regarding the limitations of the size of quay walls, the large gravity retaining wall was not really economical because hitherto it had been impossible to ascertain with accuracy the pressures and resistances imposed upon it, and those were therefore often over-estimated; and also because the material of such a wall was subjected to stresses which were for the most part far below its safe stress.

Upon reference to page 261, Mr. John Anderson would see that the Author stated that the loss of stability was compensated for by " removing the gravel behind and forming it to a slope of 1 in 1½-in.; not to a " natural slope," as stated by Mr. Anderson. It was true that had the material been removed to its natural slope the monoliths would theoretically have been subjected to little or no unbalanced horizontal thrust, but 1 in 1½ was not the natural slope, and the monoliths therefore had to sustain some horizontal thrust from the backing, as evidenced by the fact that they tilted forward slightly after the dredging in front had been done.

The retention of the original 45-ft. monoliths had been governed largely by the circumstances obtaining at the time when the trouble developed with the sinking of the earlier ones. The contractor's yard was already laid out for 45-ft. monolith blocks, nearly all the steel shoes were on the site, and a large number of the monoliths themselves had been sunk or were in the process of sinking. Furthermore, had the monoliths been made less than 45-ft. square, the compensation platform would have had to be made correspondingly wider.

The design of the wall had been carefully reviewed before work on the second stage was commenced, but it was considered that, having regard to all the circumstances, no economy would accrue by departing from the modified design as illustrated in Fig. 7, page 259.*

The maximum tilt had been observed in a portion of the modified section, where the slope had been grabbed out and the compensation-slab built prior to the removal of the material in front of the quay. The observations taken indicated that the movement was due to tilt and not to lateral displacement.

With regard to the slope behind the monoliths, the stone pitching was hand-packed above low water. Periodical observations still being taken had shown that no movement of the pitching was taking place. Vessels were permitted to have a slow trial of engines whilst lying alongside the quay; particular attention was given to the slope where those trials were being carried out, and no movement had yet been observed.

The material of the gravel embankment was prevented from " spewing " under the capping beam by rubble stone packed behind the tops of the piles.

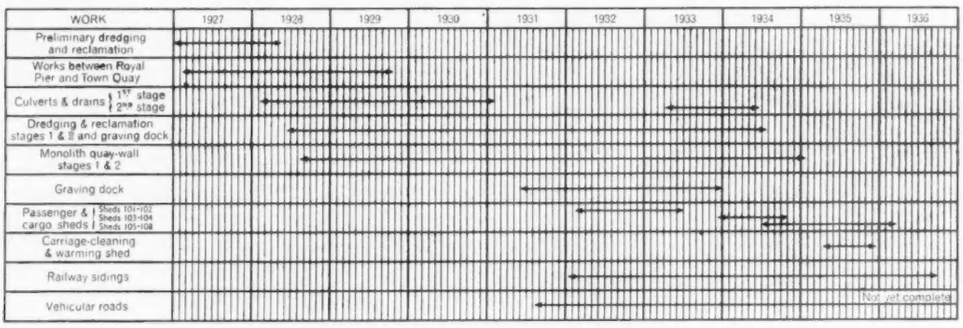


Fig. 28. Progress-Diagram of Works.

The difference between the cost of the wall built to the original design and that built to the modified design was very little, and for all practicable purposes they could be regarded as equal.

The sole reason for the change from the original to the modified design was the difficulty in sinking to the greater depth without damaging the monoliths. The result of the change was that toe-pressure was decreased and the heel-pressure increased to an extent which gave, in the modified design, almost uniform pressure over the whole of the base, but both designs could be said to be equally stable. An incidental advantage of the modified design was that it was quicker to construct.

Mr. E. J. Buckton gave a description of the quay wall recommended by his firm. That design had many merits, but it had not been adopted because, firstly, previous experience at Southampton had shown how very difficult it was to sink small monoliths through the gravel and sandy clays which obtained there (and, indeed, it seemed that small monoliths could not be sunk to the depths shown in Fig. 23, page 56, *ante*); and, secondly owing to the great disturbance and softening of the surrounding ground which took place when monoliths were sunk through such strata, it seemed doubtful whether the 1-in-2 slope over a length of 40-ft. between the monoliths, or even the monoliths themselves, would be stable.

Experience at Southampton had proved that timber-slides were very useful adjuncts to the graving docks, and they were used extensively for lowering to the dock-bottom a miscellania of articles such as drums of paint, materials for staging which had to be erected from time to time, oxygen and acetylene gas cylinders, bilge shores (in those docks where side shores were used and where bilge blocks were not provided), etc. The use of the heavy-duty cranes alongside the docks would not be economical for handling such comparatively light articles, and, moreover, the cranes were not always available, being often occupied elsewhere in dealing with the heavier loads for which they were provided; waiting for the use of the cranes might cause delays which could be ill-afforded in the case of liners running on a rigid time schedule, and where the time spent in dry dock had perforce to be reduced to a minimum. Neither would the provision of lighter-duty cranes be an economical solution. Furthermore, in each of the timber-slides was incorporated a flight of steps extending from cope-level to dock-bottom, and those provided a ready and convenient means for the workmen to get to and from the dock-bottom.

The volume of water entering the graving dock from the permanent relief pipes was approximately 150 gals. per minute.

* Fig. 7 should read " Monolith Quay Wall as Modified," and Fig. 8 " Monolith Quay Wall as originally designed."

Southampton Docks Extension—continued

It was considered that the life of the filters should be some 30 or 40 years. If at the end of that time it were thought desirable to continue their use, new wells would have to be sunk to replace them.

During the construction of the floor of the dock a large number of 2-in. diameter pipes had been built in, extending to the underside of the floor and close to the transverse and longitudinal joints, with the object of grouting up any joints which might open up due to the contraction of the concrete. It had been found, however, that very little grout could be pumped into the pipes. At a later date a number of the joints had opened up, and then holes had been drilled in the floor to intersect the joints at a low level. Cement grout had again been pumped in, and by that means the shrinkage-cracks had been effectually sealed.

No serious trouble had been experienced as a result of the settlement on the reclaimed land. The shed floors were on the site of the main gravel reclamation bank where the contractor's temporary works railways had been situated while the quay wall was being constructed. No doubt the traffic over the bank during that time had assisted in consolidating it, in addition to which the floor areas had been thoroughly well rolled before the concrete was laid. The result had been that practically no settlement had taken place on the shed floors. Elsewhere the railway lines had to be regularly attended to and packed up; the vehicular roads had settled up to a maximum of about 12-in., and, as stated in the Paper, the surface had been brought up to level where necessary with tar macadam.

No detrimental effect on the approach-channel through the reduction of scour on the ebb tide had been observed.

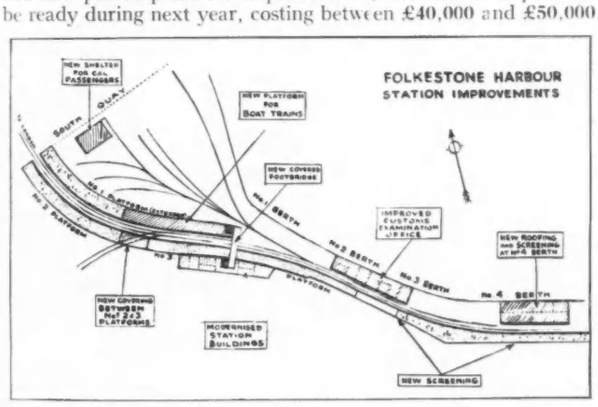
The time programme for the commencement and completion of works was given in Fig. 28.

Folkestone Harbour

Proposed Improvement of Maritime Station

Towards the end of October, the Southern Railway Company announced that Folkestone Harbour Station, which has been the subject of criticism during recent years, is to be greatly improved.

For some time, it is stated, the Railway Company has realised that the arrangements for dealing with boat-train passengers at Folkestone are behind the standard of comfort which the Company has set itself at other places on the system, and the Board has now passed plans for improvements, which, it is hoped, will be ready during next year, costing between £40,000 and £50,000.



To make Folkestone Harbour absolutely ideal, it would be necessary to reclaim and build on a wide area which is now the sea, in the same way as was done at Dover early this century. In these days, however, the cost would be prohibitive, and it will be realised, the Company points out, that with the violent fluctuations in traffic between the Continent and this country during the last few years, such a venture could not be expected at the present time. Changes in the rates of exchange and in the political aspects of various countries leave one route comfortably occupied one year, and very crowded the next. For instance, in 1936—405,198 passengers were dealt with at Folkestone, but in 1937 the number rose to 565,243; in 1937 the Dover-Ostend route was heavily taxed with passengers for Germany and Austria, whereas this year, owing to the political unrest in that part of Europe, the traffic on the Company's Southampton-St. Malo services suddenly jumped by thousands.

In spite of these commercial risks, the Southern Railway Company has determined to improve Folkestone Harbour Station, and, as a result, when there is heavy traffic, one aspect of the new scheme alone will save, on certain days, as much as 40 minutes at the port. Even more important than this, however, is the fact that, by engineering ingenuity, and in spite of cranes, engines and other difficulties, passengers will be practically always under cover from the moment they reach the bottom of the gangway.

The chief items of the scheme, indicated on the plan, are as follows:—

1.—**Improved Accommodation at No. 2 Berth.**

No. 2 Berth is the one generally used for the mail steamers. The Customs, etc., accommodation here was recently improved, but the new scheme will provide complete protection for passengers. In fact, the only exposed part of the journey from ship to Customs Examination Hall will be the passage down the gangways, where, owing to the open-sea conditions, covered gangways have not been found practicable.

2.—**Additional Protection and Improved Lighting at No. 4 Berth.**

No. 4 Berth is used for relief and excursion steamers, also for ordinary passenger services during the period of strong easterly winds, and during dredging operations, when No. 2 Berth cannot be used.

Additional covering will be provided, 110-ft. long, where embarkation and disembarkation take place, also a long glazed screen alongside No. 4 Platform, to protect against wind and rain. The lighting on the pier will also be improved.

3.—**Additional Protection between Platforms 2 and 3.**

A boat train of full length occupies the whole of Platform No. 2 and part of No. 3, and it is necessary for passengers to cross the exposed portion between the two platforms. Additional roofing will therefore be erected over the open space, together with back screens where practicable.

4.—**Longer No. 1 Platform, New Footbridge, etc.**

As it is frequently necessary during the summer months for boat trains to run in three divisions, and the existing accommodation only allows two trains to be dealt with at one time, No. 1 Platform is to be lengthened from 308-ft. to 700-ft., so that a full-length boat-train can be dealt with at this platform.

This will obviate passengers having to wait on some days up to 40 minutes, as may be the case at present when No. 4 Berth is being used.

The proposal will necessitate the provision of a covered footbridge between Nos. 1 and 3 platforms, and, in accordance with the general idea of the whole scheme of protection for passengers, the whole of the No. 1 Platform extension, and the portion of the existing platform which is uncovered, will be covered in.

5.—**Shelter on South Quay for Passengers with Motor-Cars.**

A shelter is being provided on the South Quay for the use of passengers travelling with their cars to and from the Continent, while their cars and baggage are being cleared by the Customs. This will provide a long-felt want.

The transport of motor vehicles between Folkestone and the Continent is increasing, as indicated by the following figures:—

1936—Inwards: 2,720; Outwards: 2,871
1937—Inwards: 4,316; Outwards: 4,481

6.—**Modernisation of Station Buildings.**

The station buildings will be attractively modernised, on the lines of similar schemes already carried out at many Southern Railway stations, with improved lighting, modern furniture, and bright, up-to-date refreshment rooms.

The Company again reiterates the oft-forgotten truth that, in the homeward direction, it receives the passengers at the tail-end of long Continental journeys, often across several countries. Delays en route, due to bad weather or other exceptional causes, can seldom be made up in the short distance between the ports and London. Such schemes as the one just authorised, however, are designed specially to minimise delay and to give maximum of comfort to the public.

Oil in Navigable Waters

The Minister of Agriculture and Fisheries, by a general direction dated November 9th, 1938, made under sub-section (4) of section seven of the Oil in Navigable Waters Act, 1922, authorises the institution of proceedings by any local fisheries committee constituted under the Sea Fisheries Regulation Act, 1888 (a), as amended by Sect. 51 of the Sea Fish Industry Act, 1938 (b), or by any fishery board constituted under the Salmon and Freshwater Fisheries Acts, 1923 to 1935, or under any Act relating to salmon and freshwater fisheries in force before the passing of those Acts, for an offence under the Oil in Navigable Waters Act, 1922, committed within the district of the committee or board. Provided that this direction and authority shall not apply to any offence committed by any sanitary authority or joint board. This general direction supersedes the general direction made by the Minister of Agriculture and Fisheries, dated February 20th, 1923 (S.R. & O., 1923, No. 229) (c), which is hereby revoked.

Geelong Harbour, Australia

Excerpts from the Thirty-second Annual Report of the Trust Commissioners for the Year ended 31st December, 1937

Approaches to the Port and Berths.—In the Annual Report for year 1936 it was stated that the Commissioners expected to have the new and deepened course available for traffic in the following year. Owing to unavoidable delays, occasioned by periods of unfavourable weather and the necessity for the unanticipated withdrawal from commission for overhaul of certain items of floating plant, this expectation was unfortunately not quite realised, there being still to be dredged at the end of 1937 some sections alongside berths at Corio Quay and the City piers.

At the time of going to press, a draft of 27-ft. is available, and this, it is expected, will for some time provide for all vessels likely to visit Geelong. It is, however, the intention of the Commissioners to provide a greater depth from time to time, as the growth of shipping demands.

Wharves, Piers, etc.—Towards the end of the year it was decided to demolish the large and unsightly building on Moorabool Pier and replace it with two separate cargo sheds. This action had been for some time a definite intention of the Commissioners, who, however, had postponed such works of perhaps secondary importance in favour of concentration on those having relation to the approaches to the Port. It was realised, however, that further delay was not justified, and local architects were engaged to prepare plans of a scheme of reconstruction; whereupon tenders were called for the work, which was commenced immediately after the New Year holidays. Now completed, these are useful and substantial sheds, and present a pleasing appearance in direct contrast to the original structure.

For the reason that the necessary plant and skilled workmen were busily engaged on the construction of beacons and on other urgent works connected with the Port approaches, the reconstruction of the damaged breakwater at Portarlington was postponed, but as it appeared that this plant would be in demand for some time to come, and as the plans were all in readiness, it was resolved to call for tenders, and a contract has now been let.

Finance.—The total gross revenue for the year 1937 was £105,902 11s. 1d., and the debits including a charge for depreciation, were £92,176 15s. 10d., leaving a net surplus for the year of £13,724 15s. 3d., and an accumulated surplus on Revenue Account of £45,967 10s. 5d.

Compared with the figures for the year 1936, the principal source of revenue—wharfage rates on imported goods only (£56,969 8s. 9d.)—provided the greatest increase (£8,150 1s. 2d.), and rates on vessels (15,208 14s. 9d.) were increased by £2,952 8s. 7d. This latter class of revenue is, however, of a fluctuating nature, and the rise and fall is greatly influenced by the results of wheat harvest and consequent export. The future operations of the Grain Elevators Board will have a definitely adverse effect on this form of revenue.

Trade of the Port.—For several years past, the total trade of the Port has, from year to year very considerably increased, although in some items, notably Motor Spirit, Motor Parts and Frozen Meat, there have been reductions. Owing to the periods between shipments, the first of these items, however, adjusts itself over an average period.

What is especially of interest is the continued upward trend of the overseas import trade, which, since 1920, when this class of trade was entirely non-existent, has grown to the present total of 223,652 tons, and comparison with the tonnage for year 1934 gives a percentage increase of approximately 57.

Among the export items, wheat, as usual, has the pride of place, 380,336 tons having been sent overseas in 1937, as against 245,022 tons in 1936. Of the 1937 wheat exports, Geelong handled 61 per cent., and Melbourne 39 per cent.

The total tonnages for 1937, as against 1936, were:—Imports, 453,247 (404,848) tons; Exports, 467,433 (355,410) tons; and grand totals, 920,680 (740,258) tons—an increase of 24.4 per cent. The corresponding total increase as between the previous two years was 14.3 per cent.

The shipping using the Port during 1937 had a total gross tonnage of 1,701,352, which still continues to show an increase over previous years, notwithstanding the reduction in that year of the number of individual berthings (occasioned by fewer calls of smaller craft).

Grain Elevators Board.—In the Annual Report for year 1936, it was stated that the Trust was preparing a lease to the Grain Elevators Board (with option of purchase) in respect of an area at Corio Quay for its Bulk Wheat Terminal for a period of 56 years. By direction of the Governor-in-Council, and by authority of the relative Act, this period has been now extended to 99 years, and the lease agreement has been signed by the respective parties.

Early in the year the construction of the massive silos and working-house was commenced, and at this date the terminal, which is approaching completion, dominates the landscape.

The silos, having a capacity of 2,250,000 bushels, are approximately 140-ft. in height, and the working-house adjoining raises itself a further 60-ft., with a total height of over 200-ft.

In the meantime, and in order to permit the erection of a pier by and at the cost of the Board, the necessary dredging at the site was effected by the Trust's plant, the Board, according to a condition of the lease, bearing one half the cost. It is expected that the pier will be constructed during the present year.

The report is signed by J. Spencer Nall (Chairman), Herbert A. Lumb and Edward J. Fairnie (Commissioners), and R. R. Phillips (Secretary).

Mersey Docks and Harbour Board

Annual Statement of Chairman

At a meeting of the Mersey Docks and Harbour Board held on November 17th, the chairman, Sir Richard D. Holt, Bart., said:

Last year I opened my Annual Statement by stating that "The year ending July 1st, 1937, has been even more satisfactory than the previous year." I repeat that statement in respect of the year ending July 1st, 1938.

The tonnage entering the Mersey rose from the previous record of 21,399,499 to 22,097,755, which latter figure is almost precisely double the 11,046,459 tons for the year ending July 1st, 1896—the year in which I had the honour of becoming a Member of this Board.

It is gratifying to note that in spite of the disturbances throughout the world since July 1st, the revenue for the period since July 1st, 1938, is only 2% less than for the corresponding period of last year.

In spite of the reduction of 2½% in the dues on ships using the Board's docks the revenue from rates and dues is only £300 less than that for the previous year. Other receipts have been well maintained and there is a good surplus on the warehouses which did not do well last year. Interest has fallen nearly £70,000, and though there has been a slight increase in most items of expenditure the net result is that we are able to raise by nearly £50,000, the amount carried to Unappropriated Receipts.

In connection with the reduction in dues, I should like to point out that since July 2nd, 1928, reductions have been made in the dues on ships which on the volume of business for the year ending July 1st, 1938, amount to £126,000—while the corresponding reductions on goods amount to £205,000. The position as between ships and goods under our Acts of Parliament is different in that voyages are divided into seven classes, each of which must be treated as a whole—for instance the rate charged on a New York voyage must be the same as that on a Mediterranean voyage whereas the dues on goods can be altered in respect of each commodity separately. It is therefore more convenient to reduce dues on ships by an all-round percentage and those on goods by separate items so that the former reductions get more public attention though the latter are in the aggregate greater.

As stated in the Engineer's Report, the docks have been well maintained and a new berth for the coasting trade brought into commission by converting the Princes Graving Dock, which had become useless as a graving dock, into a wet dock.

The work on the new deep water entrance at the Waterloo Dock is going on well, but another couple of years or thereabouts will be required in order to complete it.

An additional discharging berth for iron ore and other rough cargo is in course of construction in the West Float, Birkenhead, which will probably bring increased trade to the port.

The dock entrances have been well maintained and the work of improving the channel of the Mersey both in respect of available draft of water and straightening its direction has proceeded satisfactorily during the year and the results are fully in accordance with our anticipations. The magnitude of this work will be appreciated from the fact that during the year 439,549 tons of stone from the Welsh Quarries were deposited on the Training Banks and 14,505,390 tons of sand were removed from the channels by our five dredgers.

So we have had a decidedly successful year. I must express the thanks of the Board to the officials in all ranks whose loyal service has enabled these results to be obtained by my own personal thanks to Sir Thomas Brocklebank who, as Deputy Chairman, has done the chairman's work during the long period in which I was incapacitated by illness.